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STOVL FIGHTER PROPULSION RELIABILITY, MAINTAINABILITY AND SUPPORTABILITY CHARACTERIZATION

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This report contains information on the Reliability, Maintainability and Supportability R, M & S of STOVL fighter propulsion systems. Five STOVL propulsion concepts were investigated and evaluated. A R, M & S evaluation method was developed for this project. This method could not be used to rate the propulsion concepts since the components of the propulsion systems had not been fully defined. An alternative method was used to rank order the propulsion system for R, M & S. Subjective ratings were given to the major components of each propulsion concept. These ratings were then weighted and summed to determine rank order of the propulsion concepts. Propulsion components critical to the R, M & S ratings were identified. Recommendations for future R, M & S study efforts are included in the report.

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SUMMARY

The Short Take Off and Vertical Landing (STOVL) fighter propulsion reliability, maintainability and supportability characterization study was performed by Universal Technology Corporation (UTC) under contract to the Turbine Engine Division, Aero Propulsion and Power Laboratory, Wright Research and Development Center, (WDRC/POT).

The objectives of the study are listed below:

1. Estimate the reliability, maintainability and supportability (R, M & S) of STOVL fighter propulsion systems,

2. Rank order the propulsion concepts based on the R, M & S characteristics of each concept,

3. Identify the propulsion system components that are critical to the R, M & S evaluations, and

4. Recommend future STOVL propulsion R, M & S research efforts.

The information contained in this report was obtained from sources identified during a literature search and discussions with representatives of government and industry organizations. Data was collected on the following propulsion concepts: ejector augmentor, hybrid fan vectored thrust (HFVT), lift plus lift/cruise, remote augmented lift (RAL), and remote exhaust (REX). The US/UK Advanced Short Takeoff and Vertical Landing (ASTOVL) fighter studies and the NASA lift plus lift/cruise study were the best sources of information.

An evaluation method was developed for the STOVL propulsion R, M & S study. This method employs the following rating parameters; mean time between maintenance inherent (MTBMI), line replaceable unit (LRU) removal rate, shop visit rate (SVR), other subsystem/maintenance event rate, in-flight shut down (IFSD) rate, non-recoverable in-flight shut down (NRIFSD) rate and maintenance man-hours per engine flight hour (MMH/EFH). In order

to estimate the propulsion system R, M & S characteristics, component level data is needed. Once the component level data is collected, the propulsion system totals can be calculated using a math model. A spread sheet model was developed to predict system R, M & S characteristics based upon component level input. The R, M & S evaluation model, while it appears valid, was not used in this effort. The information needed was not readily available and acquiring it would have required a significant effort outside the scope of this task.

As an interim measure, the Resource Allocation and Decision Aid (RADA) software program was obtained and used to provide a subjective evaluation of the various STOVL propulsion concepts. The results of the RADA analysis are limited by the subjectivity of the evaluators.

Through the course of the STOVL propulsion concept evaluations it was found that certain components were critical to the R, M & S estimates. These components are listed below:

- Vectoring primary nozzles
- Vertical lifting exhaust nozzles
- Butterfly/Diverter valves
- Variable area bypass injectors
- Lift engine components
- RAL system burner
- Nozzle actuation systems
- Valve actuation systems
- Control systems
- Engine Bleed systems

Based on the results of this study, the following recommendations were made for STOVL fighter propulsion system R, M & S evaluation efforts:

- Define the mission profiles and design requirements to be used for the propulsion system R, M & S evaluations early,
- Identify and characterize the components of each propulsion concept,

- Obtain component level R, M & S projections from the engine and airframe contractors,

- Compute the overall R, M & S ratings for each propulsion concept by summing up the component level data,

- If the propulsion system R, M & S projections do not meet the requirements, identify components possessing low R, M & S ratings and establish development programs to improve the R, M & S characteristics of these components.

FOREWORD

The author wishes to acknowledge Mr. David Fleeger for the technical assistance he provided to this project. Mr. Fleeger's work was key to the reliability, maintainability and supportability spread sheet analysis method developed in this study.

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1.0 INTRODUCTION

UTC was tasked by the WRDC Aero Propulsion and Power Laboratory to investigate the R, M & S characteristics of various STOVL propulsion concepts. The Laboratory was interested in the R, M & S characteristics of the concepts since the engine design can be influenced by these characteristics. The study focused on the ejector augmentor, HFVT, lift plus lift/cruise, RAL and REX propulsion concepts. Information on these propulsion concepts, to the extent that it was available, was collected from the US/UK ASTOVL studies and the NASA lift plus lift/cruise study.

Four objectives were set for this study:

1. Estimate the R, M & S characteristics of the five STOVL propulsion concepts,

2. Rank order the propulsion concepts based on the R, M & S estimates,

3. Identify the propulsion system components that are critical to the R, M & S evaluations, and

4. Recommend future STOVL propulsion R, M & S research efforts.

A four step approach was used to meet the objectives of the study:

1. Collect data on the ejector augmentor, HFVT, lift plus lift/cruise, RAL and REX propulsion concepts. Obtain this data from government/industry organizations and sources identified by a literature search.

2. Develop a method to evaluate the R, M & S characteristics of the propulsion concepts,

3. Analyze the collected information in order to evaluate the R, M & S characteristics of each propulsion concept, and

4. Rank order the propulsion concepts and identify the propulsion components critical to the R, M & S estimates.

The limitations associated with the study are stated below:

1. The US/UK ASTOVL and NASA lift plus lift/cruise studies did not contain sufficient information on the propulsion system component designs to determine the R, M & S characteristics these components,

2. No significant R, M & S data was obtained from the engine contractors or the airframe contractors on the STOVL propulsion systems, and

3. The R, M & S analysis method discussed in the report was meant to establish R, M & S characteristics at the organizational level. Intermediate and depot level maintainability and supportabililty issues are not addressed in this analysis.

2.0 RELIABILITY, MAINTAINABILITY AND SUPPORTABILITY EVALUATION METHOD

A method to evaluate the R, M & S characteristics of a STOVL propulsion system was developed. The evaluation method is currently set up to provide an estimate of organizational level R, M & S. Information obtained from propulsion system flow charts, FMECA reports, technical orders, and field level reports can be used to estimate propulsion system R, M & S characteristics. Data should be gathered on each propulsion system component. After the data has been collected, the total propulsion system R, M & S can be calculated by summing the component level data. Once the R, M & S estimates have been calculated for each concept, the concepts can be compared to one another.

In order to rate propulsion system R, M & S, some measures of merit needed to be defined. The following parameters were selected to measure the R, M & S of a propulsion concept:

1. Mean time between maintenance inherent events (MTBMI),
2. Other subsystem/maintenance event rate,
3. Line replaceable unit removal rate (LRU),
4. Stop visit rate (SVR),
5. In-flight shut down rate (IFSD),
6. Non-recoverable in-flight shut down rate (NRIFSD), and
7. Maintenance man-hours per engine flight hour (MMH/EFH).

Definitions of these parameters are located in appendix A. MTBMI provides an estimate of the system reliability. IFSD and NRIFSD rates measure system safety. MMH/EFH, SVR, LRU and other subsystem/maintenance event rates are used to track system supportability and system costs. These rating parameters were selected for the model since the Propulsion System Program Office of the Aeronautical Systems Division, Wright-Patterson Air Force Base, uses these parameters to measure the R, M & S of current propulsion systems. Other measures of merit could have been selected for the model, but the ones chosen will give a good indication of the R, M & S characteristics of future propulsion concepts.

Propulsion system components need to be defined before R, M & S estimates can be made. System flow charts can be developed to show the key propulsion components. Figure 1 shows an example of a system flow chart.

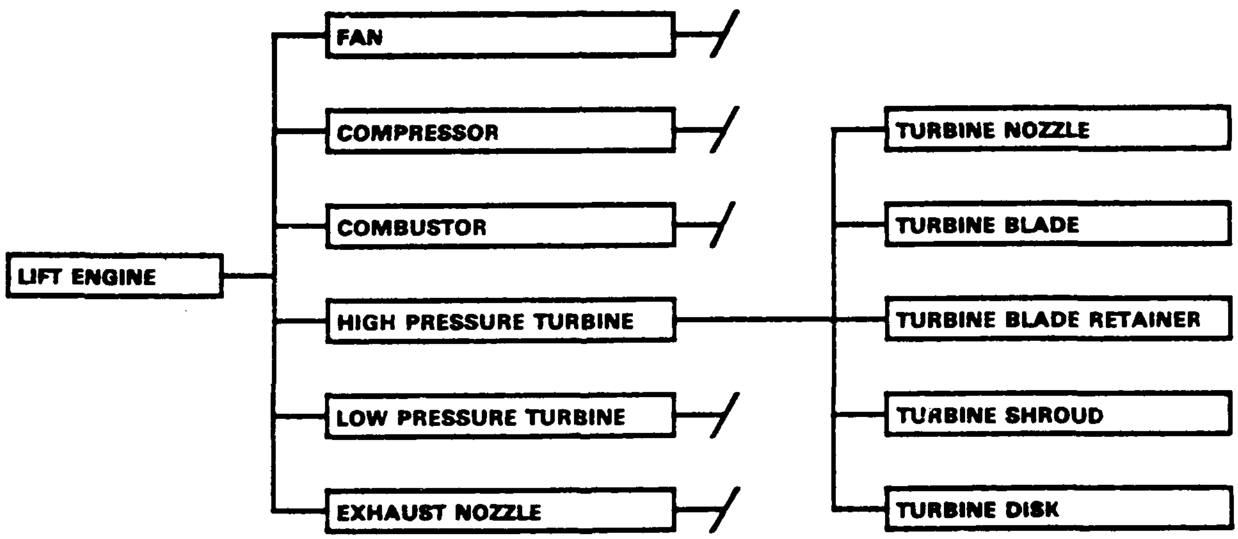

FIGURE 1. Lift Engine Flow Chart Example

After the system flow charts are developed, data must be gathered on each propulsion component. Component level R, M & S estimates can be derived from information compiled on previously developed hardware. R, M & S estimates need to account for the component usage and environment. Usage and environment information can be estimated from mission profile requirements.

The relationship between unscheduled and scheduled maintenance events needs to be included in the system evaluations since scheduled maintenance events are designed to prevent unscheduled maintenance events. Unscheduled maintenance event rates can be estimated from FMECA and field maintenance event reports of current propulsion systems. Scheduled maintenance event rates can be estimated from Technical Orders developed for fielded propulsion systems and STOVL propulsion system design requirements.

After the unscheduled and scheduled maintenance event rate estimates are established, maintenance man-hours can be estimated. Maintenance man-hours should include the time required to isolate the fault, remove a faulty component, install and check a new component. Maintenance man-hour data can be estimated from field maintenance reports and maintenance man-hour analyses conducted for previously developed propulsion systems.

Once the component level R, M & S values are determined, a math model can be used to sum the component data. A spread sheet math model was developed to calculate propulsion system unscheduled, scheduled and total maintenance event rates. A description of, and set of instructions for the spreadsheet model are in appendix B.

In order to compare the propulsion concepts, a spread sheet must be completed for each concept. The spreadsheet calculates the R, M & S parameters and places these parameter ratings in the summary section of the spreadsheet. The propulsion systems can be ranked by comparing the parameter values located on the summary sheet.

3.0 STOVL PROPULSION SYSTEM RATINGS

The R, M & S characteristics of the ejector augmentor, HFVT, lift plus lift/cruise, RAL and REX propulsion concepts were evaluated. Propulsion system flow charts were developed for each concept. The US/UK ASTOVL studies and the NASA lift plus lift/cruise study provided some inputs for the propulsion system flow charts but they did not fully define the propulsion concepts. Additional entries were made on the flow charts to represent aspects of the propulsion system that were not defined in the US/UK and NASA studies.

The components of the propulsion concepts were grouped into seven categories. Figure 2 shows the categories that were defined for the system flow charts.

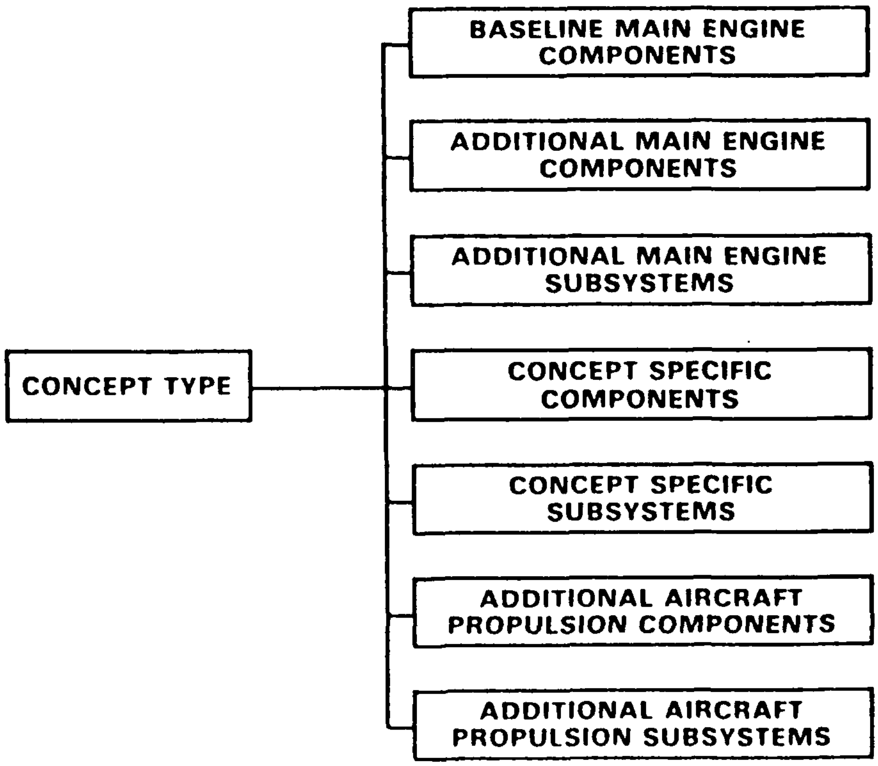

FIGURE 2. Propulsion Component Categories

The baseline main engine component group was the same for all the concepts. Appendix C contains the baseline main engine component group flow charts. The other category groups contain components that are specific to each concept. The six component groups that were developed for each concept are shown in the following appendices: Appendix D - Ejector Augmentor, Appendix E - HFVT, Appendix F - Lift plus Lift/Cruise, Appendix G - RAL, Appendix H - REX.

After the system flow charts were defined, an attempt was made to collect data on each of the STOVL propulsion components shown on the charts. However, it soon became apparent that R, M & S data was not readily available for the propulsion concepts. No component level data was contained in the US/UK ASTOVL or NASA lift plus lift/cruise studies, nor was R, M & S data, obtained from the engine and airframe manufacturers.

Another approach to estimating component level R, M & S numbers is to gather information on currently fielded components and extrapolate this data "by similarity" to the STOVL propulsion components. Reliabililty/maintainability status reports and technical orders on two current operational engines were obtained in order to explore this approach to estimating STOVL propulsion component R, M & S values. Current system component data was compiled and entered into the spread sheet formats. While the current system data is available and adequate for this approach, there is not adequate detailed design data on the STOVL propulsion components to establish the necessary similarity to current components to use this approach.

The attempts to provide a system evaluation, based upon the usual R, M & S approaches, could not be accomplished since actual STOVL hardware and design data bases are not available. Thus, a subjective evaluation of the relative R, M & S merits of the STOVL propulsion concepts was conducted.

The hierarchy used for the subjective evaluation process is given in Figure 3. The five STOVL propulsion concepts are the alternatives to be compared.

Each propulsion concept is subdivided into the six STOVL component groups identified in Figure 3. The baseline main engine component group was not included since this group was the same for all the concepts and would not affect the concept rankings. The R, M & S characteristics and their associated factors are evaluated for each component group. The basic subjective judgement which is made is at the factor level for each characteristic component group and propulsion concept. These judgments were made assuming a common mission/usage for all propulsion concepts.

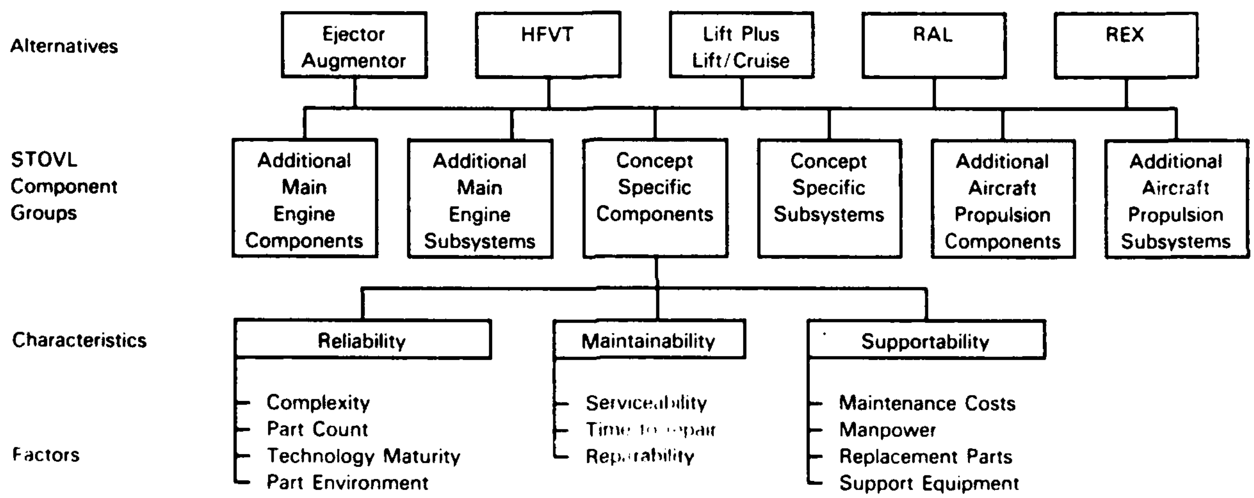

FIGURE 3. Subjective Evaluation Process Hierarchy

The ratings were conducted on a relative basis. For example, the complexity factor for the additional aircraft propulsion components of the ejector augmentor was compared to the complexity factor for the additional aircraft propulsion components of the HFVT, lift plus lift/cruise, RAL and REX systems. Raw scores for each factor were determined on a scale of 1 to 4 - 1 being the best and 4 being the worst. Weights were assigned to the factors and characteristics of each STOVL component group.

An existing Resource Allocation and Decision Aid (RADA) program was used to compute the ratings based upon the assigned raw scores and weighting factors. A brief description of this program, the input raw scores, weighting factors and the computed intermediate ratings are given in appendix I.

The relative R, M & S ratings of the five STOVL propulsion concepts for each of the six STOVL component groups is given in Table 1. The scale is 1 - 10 with 1 being best and 10 worst. The STOVL component group weighting factors (wt) used to combine these ratings into an overall propulsion concept rating also are given in table 1. The main engine and the concept specific component groups were judged to have a greater impact on the R, M & S characteristics of the propulsion systems and, thus, were given larger weighting factors.

TABLE 1 - STOVL Component Group R, M & S Ratings and Weighting Factors

	ADDITIONAL MAIN ENGINE COMPONENTS	ADDITIONAL MAIN ENGINE SUBSYSTEMS	CONCEPT SPECIFIC COMPONENTS	CONCEPT SPECIFIC SUBSYSTEMS	ADDITIONAL AIRCRAFT PROPULSION COMPONENTS	ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEMS
	WT = 2	WT = 1	WT = 2	WT = 1	WT = 1	WT = 1
EJECTOR	6	6	8	5	1	1
LIFT & LIFT/CRUISE	1	1	10	10	6	10
RALS	8	10	9	8	3	10
REX	1	1	6	4	2	10
HFVT	10	6	1	1	10	6

Table 2 displays the resulting ratings of the STOVL propulsion concepts and their rank order, from best to worst.

The REX propulsion concept had the best R, M & S characteristics due to the low ratings given to the additional main engine components, additional aircraft components, additional main engine subsystem and vertical lift subsystem groups.

The relative design simplicity and maturity of the implied technology associated with these component groups resulted in the low ratings.

The RAL propulsion concept had the worst R, M & S characteristics due the high ratings given to the additional main engine components, additional main engine subsystems, vertical lift components, vertical lift subsystems and additional aircraft subsystem groups. These groups, when put together, were more complex than the component groups associated with the other propulsion concepts. The technologies implied in the RAL system did not appear as mature as the technologies employed in other propulsion concepts.

TABLE 2. STOVL Propulsion System R, M & S Ranking

Concept	Rating	Rank
REX	1	1
Ejector Augmentor	4	2
HFVT	5	3
Lift plus lift/cruise	6	4
RAL	10	5

4.0 CRITICAL STOVL PROPULSION COMPONENTS

During the R, M & S rating process, certain STOVL propulsion components were determined to be critical to the evaluation process. Each propulsion concept has a set of these critical components. The critical components associated with each concept are listed below.

Ejector Augmentor

Additional main engine components

- Primary nozzle
- Variable area bypass injectors
- Spherical flexural joint

Additional main engine systems

- Control system
- Primary nozzle actuation system
- Variable area bypass injector actuation system

Concept specific components

- Ventral nozzle
- Ejector nozzle assembly
- Butterfly valves
- Ejector air distribution plenums

Concept specific subsystems

- Control system
- Ventral nozzle actuation system
- Butterfly valve actuation system
- Ejector door actuation system

Lift plus Lift/Cruise

Additional main engine components

- Primary nozzle

Additional main engine subsystems

- Control system
- Primary nozzle actuation system

Concept specific components

- Block and turn nozzle
- Butterfly valve
- Lift engine

Concept specific subsystems

- Control system
- Block and turn nozzle actuation system
- Butterfly valve actuation
- Lift engine fuel system
- Lift engine lubrication system

Remote Augmented Lift

Additional main engine components

- Primary nozzle
- Variable area bypass injector

Additional main engine subsystems

- Control system
- Primary nozzle actuation system
- Variable area bypass injector actuation system

Concept specific components

- RAL nozzle
- RAL burner
- Bellow clamp
- Butterfly valve

Concept specific subsystems
- Control system
- RAL burner
- RAL fuel system
- Butterfly valves actuation system

Remote Exhaust

Additional main engine components
- Primary nozzle

Additional main engine subsystems
- Control system
- Primary nozzle actuation system

Concept specific components
- Ventral nozzle
- Lift nozzle
- Butterfly valves
- Expansion bellows

Concept specific subsystems
- Control system
- Ventral nozzle actuation system
- Lift nozzle actuation system
- Butterfly valve actuation

Hybrid Fan Vectored Thrust

Additional main engine components
- Primary nozzle
- Long low pressure shaft

Additional main engine subsystems
- Control system
- Primary nozzle actuation

Concept specific components
- Front nozzles
- Diverter valve

Concept specific subsystems
- Control system
- Front nozzle actuation system
- Diverter valve actuation system

In order to refine the R, M & S rating process discussed in section 3.0, defined design data will need to be available on these critical STOVL propulsion components. The R, M & S characteristics of these components will be hard to estimate based on similarity since many of the STOVL components are not closely related components of current propulsion systems.

5.0 CONCLUSIONS

The R, M & S characteristics of various STOVL propulsion concepts were addressed in this study. The lack of detailed design data for the STOVL propulsion concepts precluded applying the usual component allocation build-up or "similarity" approaches to estimating the R, M & S characteristics of these concepts. A spread sheet evaluation model was generated which should provide increasingly realistic R, M & S evaluations as design configurations solidify. A subjective evaluation process was developed and applied to the STOVL propulsion concepts examined in this study. The framework for the process was based on system flow charts developed for each STOVL propulsion concept. Judgments were made on the concept. The resulting rankings are listed (from best to worst) in Table 2.

During the evaluations, a group of the propulsion components were determined to be critical to the STOVL propulsion system R, M & S estimates. These components are listed below:

- Vectoring primary nozzles
- Vertical lifting exhaust nozzles
- Butterfly/Diverter valves
- Variable area bypass injectors
- Lift engine components
- RAL burner
- Nozzle actuation systems
- Valve actuation systems
- Control systems
- Engine bleed systems

A component allocation-based analysis will be needed to predict to the R, M & S characteristics of the various propulsion concepts. Detailed design work and sub-system testing will provide increasing realistic inputs to future R, M & S evaluations.

6.0 RECOMMENDATIONS

The following recommendations were made for future STOVL fighter propulsion R, M & S studies.

- Define the mission profiles and design requirements to be used for the propulsion system R, M & S evaluations. If the actual field environment is different from the environment used for the propulsion system evaluations, the results of the R, M & S evaluation may be inaccurate.

- Identify the components of each propulsion concept. Component level allocations will be used to calculate the total propulsion system R, M & S estimates. Propulsion system flow charts can be used to identify all the components. Engine and airframe contractors will need to supply information for this effort.

- Obtain component level R, M & S projections from the engine and airframe contractors. Detailed design studies and testing may be required to provide accurate component level R, M & S projections.

- Compute the overall R, M & S ratings for each propulsion concept by summing the component data in a R, M & S math model. A model similar to the spread sheet analysis method discussed in this study could be used.

- If the propulsion system R, M & S projections do not meet the system requirements, components possessing low R, M & S projections will need to be identified. Development programs should be established to improve the R, M & S characteristics of low rated components.

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APPENDIX A

RELIABILITY, MAINTAINABILITY AND SUPPORTABILITY DEFINITIONS

In-flight shut down rate (IFSD)

The total number of engine chargeable shut downs, divided by the total EFH for the calculation period, times 1,000. In-flight shut downs include those events involving the stoppage of an engine that are necessary in the judgment of the pilot or air crew to prevent airframe/engine damage and personnel hazards. They include both recoverable and non-recoverable IFSD's.

Non-recoverable in-flight shut down rate (NRIFSD) (single engine aircraft)

The total number of engine chargeable non-recoverable shut downs, divided by the total EFH for the calculation period, times 1,000. Non-recoverable in-flight shut downs include those events involving engine stoppages that can not be restarted or engine power losses that would not allow the aircraft to return to a landing site. If a restart is not attempted, an assessment of the cause of the shut down will be made to determine if a restart would have been successful.

Line replaceable unit (LRU) removal rate

The sum of the inherent scheduled and unscheduled LRU removals, divided by the total EFH for the calculation period, times 1,000. Components subsequently bench-checked ok in the shop are not excluded. Multiple, identical LRUs replaced at the same time are considered a single event. If LRUs fail independently, each failure shall be counted as a removal.

Shop visit rate (SVR) (engine chargeable)

The sum of the inherent scheduled and unscheduled engine removals divided by the total EFH for the calculation period, times 1,000.

Other subsystem removal rate

The sum of the inherent scheduled and unscheduled other subsystem removals, divided by the total EFH for the calculation period, times 1,000.

Maintenance man-hour (MMH)

Maintenance man-hours include all man-hours required to maintain the engine for all engine causes. These man-hours include the time required for fault isolation and checkout, engine removal and replacement, engine buildup and teardown, component repair and adjustment, component removal and replacement, scheduled inspections, and all other engine service (including time compliance technical order accomplishment). Note: unless otherwise stated, 100% efficiency is assumed for MMH\EFH (efficiency factors must be applied to predict true operational values).

Mean time between maintenance-inherent (MTBMI)

Average engine flight hours between inherent maintenance events at the organizational level of maintenance.

APPENDIX B

SPREAD SHEET DESCRIPTION AND INSTRUCTIONS

The spread sheet model can be used to estimate the reliability, maintainability, and supportability of a propulsion system. The spread sheet was developed with the Symphony software package. An introduction and a spread sheet layout diagram are included in the model. The introduction and layout diagram are shown on the following page.

The R, M & S criteria used to rate the propulsion systems are listed below:

1. Inherent Maintenance Events (MI)
2. Other Subsystem/Maintenance event rate
3. Line Replaceable Unit Removal Rate (LRU)
4. Shop Visit Rate (SVR)
5. In-Flight Shut Down Rate (IFSD)
6. Non-Recoverable In-Flight Shut Down Rate (NRIFSD)
7. Maintenance Man-Hours per Engine Flight Hour (MMH/EFH).

Definitions of these parameters are given in appendix A. The model requires inputs for each of these parameters at the propulsion component level.

Component level data will need to be input into each section of the spread sheet. The model has seven calculation sheets:

1. Summary sheet
2. Unscheduled major propulsion subsystem events sheet
3. Scheduled major propulsion subsystem events sheet
4. Unscheduled line replaceable unit events sheet
5. Scheduled line replaceable unit events sheet
6. Unscheduled other subsystem/maintenance events sheet
7. Scheduled other subsystem/maintenance events sheet.

These seven calculation sheets are described on the following pages.

SPREADSHEET INTRODUCTION AND LAYOUT

The introduction included in the spread sheet model is shown below:

The Universal Technology Corporation propulsion system reliability, maintainability and supportability model is designed to estimate the R, M & S characteristics of propulsion systems. Standard ASD/YZ parameters, definitions and data analysis methods are used.

The model is divided into seven major sections:

1. R, M & S Summary Sheet
2. Unscheduled Major Propulsion Subsystem Events Sheet
3. Scheduled Major Propulsion Subsystem Events Sheet
4. Unscheduled Line Replaceable Unit Events Sheet
5. Scheduled Line Replaceable Unit Events Sheet
6. Unscheduled Other Subsystems/Maintenance Events Sheet
7. Scheduled Other Subsystems/Maintenance Events Sheet.

Data inputs are required in each of the seven major sections. Portions of the spread sheet are protected to prevent incorrect cell entries. The spread sheet instructions should be read before data is entered into the model.

SPREADSHEET LAYOUT

The general layout of the model is shown in figure 4.

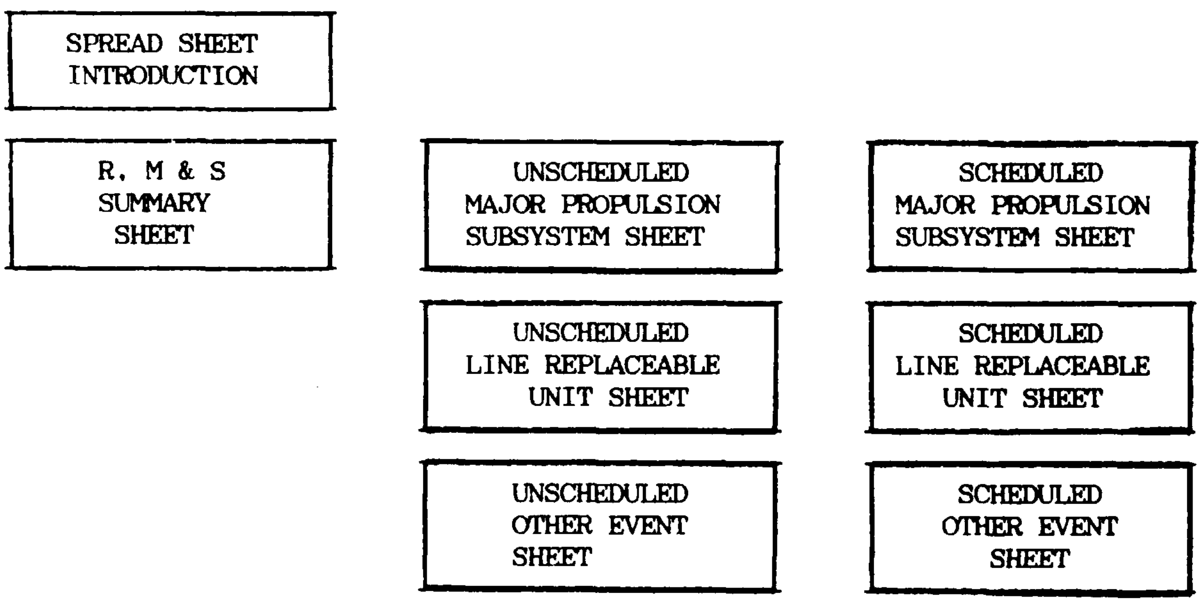


FIGURE 4. Spread Sheet Layout Diagram

SUMMARY SHEET

This sheet is partitioned into four tables:

1. Propulsion system general information table
2. Unscheduled events summary table
3. Scheduled events summary table
4. Combined unscheduled and scheduled events summary table.

Information on each table is provided below.

General Information Sheet

This table contains basic information on the propulsion system. The inputs required for this sheet are listed below. The entry location for each input is shown on table 3.

1. Propulsion concept
2. Aircraft manufacturer
3. Aircraft model
4. Engine manufacturer
5. Engine model
6. Ground Rules

   A. Baseline mission profile
   B. New mission profile (used only when the effects of new mission profiles are being estimated)
   C. Total accumulated flight hours for the entire engine fleet
   D. Number of propulsion systems in the fleet
   E. Evaluation time period (number of engine flight hours that accumulate during the maintenance data collection time period)
   F. Average vertical propulsion system operating time per propulsion system.

TABLE 3. Propulsion System General Information

GENERAL INFORMATION
1. PROPULSION CONCEPT:
2. AIRCRAFT MFG:
3. A/C CONFIGURATION/MODEL:
4. ENGINE MFG:
5. ENGINE CONFIGURATION/MODEL:
6. GROUND RULES:
A. BASELINE MISSION PROFILE/MIX NUMBER:
B. NEW MISSION PROFILE/MIX NUMBER:
C. AVERAGE EFH PER PROPULSION SYSTEM:
D. NUMBER OF PROPULSION SYSTEMS:
E. EVENT RATE EVALUATION TIME:
F. AVERAGE VERTICAL EFH PER SYSTEM:

Unscheduled Events Summary Table

This table sums up all the unscheduled maintenance events. Data is automatically collected from the Unscheduled Major Propulsion Subsystem Events Sheet, the Unscheduled Line Replaceable Unit Events Sheet and the Unscheduled Other Subsystem/Maintenance Events Sheet. No inputs are required on table 4.

TABLE 4. Unscheduled Events Summary

UNSCHEDULED EVENTS	UNSCHEDULED EVENTS PER CATEGORY (EVENT/1K EFH)							CONTRI-BUTION OF CATEGORY TO UNSCHEDULED MMH/EFH
	MI	OTHER	LRU	SVR	IFSD	NRI FSD	MTBMI	
MAJOR PROPULSION SUBSYSTEMS	0	N/A	N/A	0	0	0	ERR	0
LINE REPLACEABLE UNITS	0	0	0	0	0	0	ERR	0
OTHER MAINTENANCE EVENTS	0	0	0	0	0	0	ERR	0
TOTALS (ALL CATEGORIES)	0	0	0	0	0	0	ERR	0

Scheduled Events Summary Table:

This table sums up all the scheduled maintenance events. Data is automatically collected from the Scheduled Major Propulsion Subsystem Events Sheet, the Scheduled Line Replaceable Unit Events Sheet and the Scheduled Other Subsystem/Maintenance Events Sheet. No inputs are required on this table 5.

TABLE 5. Scheduled Events Summary

SCHEDULED EVENTS	SCHEDULED EVENTS PER CATEGORY (EVENT/1K EFH)							CONTRI-BUTION OF CATEGORY TO SCHEDULED MMH/EFH
	MI	OTHER	LRU	SVR	IFSD	NRI FSD	MTBMI	
MAJOR PROPULSION SUBSYSTEMS	N/A	N/A	N/A	0	N/A	N/A	N/A	0
LINE REPLACEABLE UNITS	N/A	N/A	0	N/A	N/A	N/A	N/A	0
OTHER MAINTENANCE EVENTS	N/A	0	N/A	N/A	N/A	N/A	N/A	0
TOTALS (ALL CATEGORIES)	N/A	0	0	0	N/A	N/A	N/A	0

Combined Unscheduled and Scheduled Events Summary Table:

This table sums up all unscheduled and scheduled maintenance events. Data is automatically collected from the unscheduled events summary table and the scheduled events summary table. No inputs are required on table 6.

TABLE 6. Unscheduled and Scheduled Events Summary

UNSCHEDULED AND SCHEDULED EVENTS COMBINED	UNSCHEDULED AND SCHEDULED EVENTS PER CATEGORY							UNSCHEDULED AND SCHEDULED MMH/EFH
	MI	OTHER	LRU	SVR	IFSD	NRI FSD	MTBMI	
MAJOR PROPULSION SUBSYSTEMS	0	N/A	N/A	0	0	0	ERR	0
LINE REPLACEABLE UNITS	0	0	0	0	0	0	ERR	0
OTHER MAINTENANCE EVENTS	0	0	0	0	0	0	ERR	0
TOTALS (ALL CATEGORIES)	0	0	0	0	0	0	ERR	0

Unscheduled Major Propulsion Subsystem Events Sheet

This sheet holds information on the unscheduled maintenance events associated with the major propulsion subsystems. The systems that should be entered on this table include structural frames, rotating hardware, static gas path structures, exhaust nozzles, and so on. Table 7 shows the Unscheduled Major Propulsion Subsystem Events Sheet.

The inputs required for this sheet are listed below. The entry location for each input is shown on table 7.

1. Major propulsion subsystem names

2. Subsystem unscheduled baseline maintenance event rate - maintenance events per 1000 engine flight hours

3. Event rate ratio - used to adjust the baseline maintenance event rates for new mission profile evaluations or for sensitivity analyses

4. Probability of an unscheduled subsystem event affecting the inherent maintenance event rate - the probability that a maintenance event will result in an inherent maintenance event

5. Probability of an unscheduled subsystem event affecting the other subsystem maintenance event rate - the probability that a maintenance event will result in an other subsystem removal (non-applicable for this sheet)

6. Probability of an unscheduled subsystem event affecting the line replaceable unit removal rate - the probability that a maintenance event will result in a line replaceable unit removal (non-applicable for this sheet)

7. Probability of an unscheduled subsystem event affecting the shop visit rate - the probability that a maintenance event will result in a shop visit event

8. Probability of an unscheduled subsystem event affecting the in-flight shut down rate - the probability that a maintenance event will result in an in-flight shut down

9. Probability of an unscheduled subsystem event affecting the non-recoverable in-flight shut down rate - the probability that a maintenance event will result in a non-recoverable shut down

10. Number of subsystems with common event rate

11. Average organizational level maintenance man-hours per other subsystem/maintenance event (100% efficiency) (non-applicable to this sheet)

12. Average organizational level maintenance man-hours per line replaceable unit removal event (100% efficiency) (non-applicable to this sheet)

13. Average organizational level maintenance man-hours per shop visit event (100% efficiency)

14. Maintenance man-hour efficiency factor.

This sheet has seven columns that contain calculated data. The location of each column is indicated on table 7. The equations for each column are listed below.

1. Contribution of the subsystem to the inherent maintenance event rate (events per 1000 engine flight hours)

$$\boxed{\begin{array}{c}\text{Subsystem}\\\text{unscheduled}\\\text{baseline}\\\text{maintenance}\\\text{event rate}\end{array}} \times \boxed{\begin{array}{c}\text{Event}\\\text{rate}\\\text{ratio}\end{array}} \times \boxed{\begin{array}{c}\text{Probability of}\\\text{the subsystem}\\\text{event affecting}\\\text{the inherent}\\\text{maintenance}\\\text{event rate}\end{array}} \times \boxed{\begin{array}{c}\text{Number of}\\\text{subsystems}\\\text{with common}\\\text{event rate}\end{array}}$$

2. Contribution of the subsystem to the other subsystem/maintenance event rate (non-applicable to this sheet)

3. Contribution of the subsystem to the line replaceable unit removal rate (non-applicable to this sheet)

4. Contribution of the subsystem to the shop visit rate (events per 1000 engine flight hours)

$$\boxed{\begin{array}{c}\text{Subsystem}\\\text{unscheduled}\\\text{baseline}\\\text{maintenance}\\\text{event rate}\end{array}} \times \boxed{\begin{array}{c}\text{Event}\\\text{rate}\\\text{ratio}\end{array}} \times \boxed{\begin{array}{c}\text{Probability of}\\\text{the subsystem}\\\text{event affecting}\\\text{the shop visit}\\\text{event rate}\end{array}} \times \boxed{\begin{array}{c}\text{Number of}\\\text{subsystems}\\\text{with common}\\\text{event rate}\end{array}}$$

5. Contribution of the subsystem to the in-flight shut down rate (events per 1000 engine flight hours)

Subsystem unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of the subsystem event affecting the shop visit event rate	X	Number of subsystems with common event rate

6. Contribution of the subsystem to the non-recoverable in-flight shut down rate (events per 1000 engine flight hours)

Subsystem unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of the subsystem event affecting the in-flight shut down event rate	X	Number of subsystems with common event rate

7. Contribution of the subsystem to the maintenance man-hours per engine flight hour.

Contribution of subsystem to shop visit rate	X	Average organizational level shop visit maintenance man-hours	X	Maintenance man-hour efficiency factor	÷	1000

This sheet will sum the data contained in the following columns:

1. Contribution of the subsystem to the inherent maintenance event rate

2. Contribution of the subsystem to the shop visit rate

3. Contribution of the subsystem to the in-flight shut down rate

4. Contribution of the subsystem to the non-recoverable in-flight shut down rate

5. Contribution of the subsystem to the maintenance man-hours per engine flight hour.

4. Contribution of the line replaceable unit to the shop visit rate

5. Contribution of the line replaceable unit to the in-flight shut down rate

6. Contribution of the line replaceable unit to the non-recoverable in-flight shut down rate

7. Contribution of the line replaceable unit to the maintenance man-hours per engine flight hour.

TABLE 7. Unscheduled Major Propulsion Subsystem Events

UNSCHEDULED MAJOR PROPULSION SUBSYSTEM EVENTS																					
	MAJOR PROPULSION SUBSYSTEMS	SUBSYSTEM UNSCHEDULED BASELINE MAINTENANCE EVENT RATE (EVENT/1K EFH)	EVENT RATE RATIO	PROBABILITY OF UNSCHEDULED SUBSYSTEM EVENT AFFECTING EACH PARAMETER						NUMBER OF SUBSYSTEMS WITH COMMON EVENT RATE	CONTRIBUTION OF SUBSYSTEM TO EACH PARAMETER (EVENTS/1K EFH)						AVERAGE ORG-LEVEL UNSCHEDULED MMH PER EVENT (100% EFFICIENCY)			MMH EFFICIENCY FACTOR	CONTRI-BUTION OF SUBSYSTEM TO MMH/EFH
				MI	OTHER	LRU	SVR	IPSD	NRIFSD		MI	OTHER	LRU	SVR	IPSD	NRIFSD	OTHER	LRU	SVR		
1																					
2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	[1]	[2]	[3]	[4]	[5]	[6]	(11)	(12)	(13)	(14)	[7]
3																					
4																					
5			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
6			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
7			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
8			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
9			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
10			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
11			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
12			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
13			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
14			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
15			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
16			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
17			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
18			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
19			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
20			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
21			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
22			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
23			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
24			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
25			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
26			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
27			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
28			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
29			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
30			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
31			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
32			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
33			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
34			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
35			1		N/A	N/A					0	N/A	N/A	0	0	0	N/A	N/A			0
	MAJOR SUBSYSTEM TOTALS										0	N/A	N/A	0	0	0					0

( ) Required inputs
[ ] Calculated Numbers

Scheduled Major Propulsion Subsystem Events Sheet

This sheet holds information on the scheduled maintenance events associated with the major propulsion subsystems. The systems that should be entered on this table include structural frames, rotating hardware, static gas path structures, exhaust nozzles, and so on. Table 8 shows the Scheduled Major Propulsion Subsystem Events Sheet.

The inputs required for this sheet are listed below. The entry location for each input is shown on table 8.

1. Major propulsion subsystem name
2. Subsystem scheduled baseline maintenance event rate (events per 1000 engine flight hours)
3. Event rate ratio
4. Scheduled event type - shop visit (subsystem events that cause a shop visit)
5. Scheduled event type - maintenance man-hour (subsystem events that cause maintenance personnel actions)
6. Average organizational level maintenance man-hours per event (100% efficiency)
7. Maintenance man-hour efficiency factor.

This sheet has three columns that contain calculated data. The location of each column is indicated on table 8. The equations for each column are listed below.

1. Contribution of the subsystem to the scheduled shop visit rate (events per 1000 engine flight hours)

Subsystem scheduled baseline maintenance event rate	X	Event rate ratio	X	Scheduled event type (shop visit)

2. Contribution of the subsystem to the scheduled maintenance man-hour event rate

$$\boxed{\begin{array}{c}\text{Subsystem scheduled}\\ \text{baseline maintenance}\\ \text{event rate}\end{array}} \times \boxed{\begin{array}{c}\text{Event}\\ \text{rate}\\ \text{ratio}\end{array}} \times \boxed{\begin{array}{c}\text{Scheduled event}\\ \text{type (maintenance}\\ \text{man-hours)}\end{array}}$$

3. Contribution of the subsystem to the scheduled maintenance man-hours per engine flight hour.

$$\boxed{\begin{array}{c}\text{Contribution of}\\ \text{the subsystem to}\\ \text{the scheduled}\\ \text{maintenance man-}\\ \text{hour event rate}\end{array}} \times \boxed{\begin{array}{c}\text{Average}\\ \text{organizational}\\ \text{level maintenance}\\ \text{man-hour}\\ \text{per event}\end{array}} \times \boxed{\begin{array}{c}\text{Maintenance}\\ \text{man-hour}\\ \text{efficiency}\\ \text{factor}\end{array}} \div \boxed{1000}$$

This sheet will sum the data contained in the following columns:

1. Contribution of the subsystem to the scheduled shop visit rate

2. Contribution of the subsystem to the scheduled maintenance man-hours per engine flight hour.

TABLE 8. Scheduled Major Propulsion Subsystem Events

	SCHEDULED MAJOR PROPULSION SUBSYSTEM EVENTS									
	MAJOR PROPULSION SUBSYSTEMS	SUBSYSTEM SCHEDULED BASELINE MAINTENANCE EVENT RATE (EVENT/1K EFH)	EVENT RATE RATIO	SCHEDULED EVENT TYPE		CONTRIBUTION OF EACH SUBSYSTEM TO SCHEDULED ORG LEVEL EVENTS (EVENT/1K EFH)		AVERAGE ORG LEVEL MMH PER EVENT 100% EFFICIENCY	MMH EFFICIENCY FACTOR	CONTRI-BUTION OF SUBSYSTEM TO SCHEDULED O-LEVEL MMH/EFH
				SVR	MMH	S'R	MMH			
1										
2	(1)	(2)	(3)	(4)	(5)	[1]	[2]	(6)	(7)	[3]
3										
4										
5			1	1	1	0	0			0
6			1	1	1	0	0			0
7			1	1	1	0	0			0
8			1	1	1	0	0			0
9			1	1	1	0	0			0
10			1	1	1	0	0			0
11			1	1	1	0	0			0
12			1	1	1	0	0			0
13			1	1	1	0	0			0
14			1	1	1	0	0			0
15			1	1	1	0	0			0
16			1	1	1	0	0			0
17			1	1	1	0	0			0
18			1	1	1	0	0			0
19			1	1	1	0	0			0
20			1	1	1	0	0			0
21			1	1	1	0	0			0
22			1	1	1	0	0			0
23			1	1	1	0	0			0
24			1	1	1	0	0			0
25			1	1	1	0	0			0
26			1	1	1	0	0			0
27			1	1	1	0	0			0
28			1	1	1	0	0			0
29			1	1	1	0	0			0
30			1	1	1	0	0			0
31			1	1	1	0	0			0
32			1	1	1	0	0			0
33			1	1	1	0	0			0
34			1	1	1	0	0			0
35			1	1	1	0	0			0
	MAJOR SUBSYSTEM TOTALS					0				0

( ) Required inputs
[ ] Calculated numbers

Unscheduled Line Replaceable Unit Events Sheet

This sheet holds information on the unscheduled maintenance events associated with the line replaceable units. The units that should be entered on this table include fuel pumps, fuel controls, ignition exciters, oil pumps, and so on. Table 9 shows the Unscheduled Line Replaceable Unit Events Sheet.

The inputs required for this sheet are listed below. The entry location for each input is shown on table 9.

1. Line replaceable unit names
2. Line replaceable unit unscheduled baseline maintenance event rate (events per 1000 engine flight hours)
3. Event rate ratio
4. Probability of an unscheduled line replaceable unit event affecting the inherent maintenance event rate
5. Probability of an unscheduled line replaceable unit event affecting the other subsystem/maintenance event rate
6. Probability of an unscheduled line replaceable unit event affecting the line replaceable unit removal rate
7. Probability of an unscheduled line replaceable unit event affecting the shop visit rate
8. Probability of an unscheduled line replaceable unit event affecting the in-flight shut down rate
9. Probability of an unscheduled line replaceable unit event affecting the non-recoverable in-flight shut down rate
10. Number of line replaceable units with a common event rate
11. Average organizational level maintenance man-hours per other subsystem/maintenance event (100% efficiency)
12. Average organizational level maintenance man-hours per line replaceable unit removal event (100% efficiency)
13. Average organizational level maintenance man-hours per shop visit event (100% efficiency)

14. Maintenance man-hour efficiency factor.

This sheet has seven columns that contain calculated data. The location of each column is indicated on table 9. The equations for each column are listed below.

1. Contribution of the line replaceable unit event to the inherent maintenance event rate (events per 1000 engine flight hours)

Line replaceable unit unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled line replaceable unit event affecting the inherent maintenance events	X	Number of line replaceable units with a common event rate

2. Contribution of the line replaceable unit event to the other subsystem/maintenance event rate (events per 1000 engine flight hours)

Line replaceable unit unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled line replaceable unit event affecting the other subsystem removal rate	X	Number of line replaceable units with a common event rate

3. Contribution of the line replaceable unit event to the line replaceable unit removal rate (events per 1000 engine flight hours)

Line replaceable unit unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled line replaceable unit event affecting the line replaceable removal rate	X	Number of line replaceable units with a common event rate

4. Contribution of the line replaceable unit event to the shop visit rate (events per 1000 engine flight hours)

Line replaceable unit unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled line replaceable unit event affecting the shop visit rate	X	Number of line replaceable units with a common event rate

5. Contribution of the line replaceable unit event to the in-flight shut down rate (events per 1000 engine flight hours)

Line replaceable unit unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled line replaceable unit event affecting the in-flight shut down rate	X	Number of line replaceable units with a common event rate

6. Contribution of the line replaceable unit event to the non-recoverable in-flight shut down rate (events per 1000 engine flight hours)

Line replaceable unit unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled line replaceable unit event affecting the non-recoverable in-flight shut down rate	X	Number of line replaceable units with a common event rate

7. Contribution of the line replaceable unit to the maintenance man-hours per engine flight hour.

[(Contribution of the line replaceable unit to the other subsystem removal rate X Average organizational level maintenance man-hours per other subsystem removal rate)

+

(Contribution of the line replaceable unit to the line replaceable unit removal rate X Average organizational level maintenance man-hours per line replaceable unit removal rate)

+

(Contribution of the line replaceable unit to the shop visit rate X Average organizational level maintenance man-hours per shop visit event)]

X Maintenance man-hour efficiency factor ÷ 1000

This sheet will sum the data contained in the following columns:

1. Contribution of the line replaceable unit to the inherent maintenance event rate

2. Contribution of the line replaceable unit to the other subsystem removal rate

3. Contribution of the line replaceable unit to the line replaceable unit removal rate

4. Contribution of the line replaceable unit to the shop visit rate

5. Contribution of the line replaceable unit to the in-flight shut down rate

6. Contribution of the line replaceable unit to the non-recoverable in-flight shut down rate

7. Contribution of the line replaceable unit to the maintenance man-hours per engine flight hour.

TABLE 9. Unscheduled Line Replaceable Unit Events

UNSCHEDULED LINE REPLACEABLE UNIT EVENTS																					
	LINE REPLACEABLE UNITS	LRU UNSCHEDULED BASELINE MAINTENANCE EVENT RATE (EVENT/1K BFH)	EVENT RATE RATIO	PROBABILITY OF UNSCHEDULED LRU EVENT AFFECTING EACH PARAMETER						NUMBER OF LRU'S WITH COMMON EVENT RATE	CONTRIBUTION OF LRU TO EACH PARAMETER (EVENTS/1K BFH)						AVERAGE ORG-LEVEL UNSCHEDULED MMH PER EVENT (100% EFFICIENCY)			MMH EFFICIENCY FACTOR	CONTRI-BUTION OF LRU TO MMH/BFH
				NI	OTHER	LRU	SVR	IFSD	NRIFSD		NI	OTHER	LRU	SVR	IFSD	NRIFSD	OTHER	LRU	SVR		
1																					
2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	[1]	[2]	[3]	[4]	[5]	[6]	(11)	(12)	(13)	(14)	[7]
3																					
4																					
5			1								0	0	0	0	0	0					0
6			1								0	0	0	0	0	0					0
7			1								0	0	0	0	0	0					0
8			1								0	0	0	0	0	0					0
9			1								0	0	0	0	0	0					0
10			1								0	0	0	0	0	0					0
11			1								0	0	0	0	0	0					0
12			1								0	0	0	0	0	0					0
13			1								0	0	0	0	0	0					0
14			1								0	0	0	0	0	0					0
15			1								0	0	0	0	0	0					0
16			1								0	0	0	0	0	0					0
17			1								0	0	0	0	0	0					0
18			1								0	0	0	0	0	0					0
19			1								0	0	0	0	0	0					0
20			1								0	0	0	0	0	0					0
21			1								0	0	0	0	0	0					0
22			1								0	0	0	0	0	0					0
23			1								0	0	0	0	0	0					0
24			1								0	0	0	0	0	0					0
25			1								0	0	0	0	0	0					0
26			1								0	0	0	0	0	0					0
27			1								0	0	0	0	0	0					0
28			1								0	0	0	0	0	0					0
29			1								0	0	0	0	0	0					0
30			1								0	0	0	0	0	0					0
31			1								0	0	0	0	0	0					0
32			1								0	0	0	0	0	0					0
33			1								0	0	0	0	0	0					0
34			1								0	0	0	0	0	0					0
35			1								0	0	0	0	0	0					0
	LRU TOTALS										0	0	0	0	0	0					0

( ) Required inputs
[ ] Calculated numbers

Scheduled Line Replaceable Unit Events Sheet

This sheet holds information on the scheduled maintenance events associated with the line replaceable units. The systems that should be entered on this table include fuel pumps, fuel controls, ignition exciters, oil pumps, and so on. Table 10 shows the Scheduled Line Replaceable Unit Event Sheet.

The inputs required for this sheet are listed below. The entry location for each input is shown on table 10.

1. Line replaceable unit names
2. Line replaceable unit scheduled baseline maintenance event rate (events per 1000 engine flight hours)
3. Event rate ratio
4. Scheduled event type - line replaceable unit (line replaceable unit events that cause a line replaceable unit removal)
5. Scheduled event type - maintenance man-hour (line replaceable unit events that cause maintenance personnel actions)
6. Average organizational level maintenance man-hours per event (100% efficiency)
7. Maintenance man-hour efficiency factor.

This sheet has three columns that contain calculated data. The location of each column is indicated on table 10. The equations for each column are listed below:

1. Contribution of the line replaceable unit event to scheduled line replaceable removal rate (events per 1000 engine flight hours)

Line replaceable unit scheduled baseline maintenance event rate	X	Event rate ratio	X	Scheduled event type (line replaceable unit)

2. Contribution of the line replaceable unit to the scheduled maintenance man-hour event rate

Line replaceable unit scheduled baseline maintenance event rate	X	Event rate ratio	X	Scheduled event type (maintenance man-hours)

3. Contribution of the line replaceable unit to the scheduled maintenance man-hours per engine flight hour.

Contribution of the line replaceable unit to the scheduled maintenance man-hour event rate	X	Average organizational level maintenance man-hours per event	X	Maintenance man-hour efficiency factor	÷	1000

This sheet will sum the data contained in the following columns:

1. Contribution of the line replaceable unit to the scheduled line replaceable removal rate

2. Contribution of the line replaceable unit to the scheduled maintenance man-hours per engine flight hour.

TABLE 10. Scheduled Line Replaceable Events

SCHEDULED LINE REPLACEABLE UNIT EVENTS										
	LINE REPLACEABLE UNITS	LRU SCHEDULED BASELINE MAINTENANCE EVENT RATE (EVENT/1K EFH)	EVENT RATE RATIO	SCHEDULED EVENT TYPE		CONTRIBUTION OF EACH LRU TO SCHEDULED ORG LEVEL EVENTS (EVENT/1K EFH)		AVERAGE ORG LEVEL MMH PER EVENT 100% EFFICIENCY	MMH EFFICIENCY FACTOR	CONTRI-BUTION OF LRU TO SCHEDULED O-LEVEL MMH/EFH
				LRU	MMH	LRU	MMH			
1										
2	(1)	(2)	(3)	(4)	(5)	[1]	[2]	(6)	(7)	[3]
3										
4										
5			1	1	1	0	0			0
6			1	1	1	0	0			0
7			1	1	1	0	0			0
8			1	1	1	0	0			0
9			1	1	1	0	0			0
10			1	1	1	0	0			0
11			1	1	1	0	0			0
12			1	1	1	0	0			0
13			1	1	1	0	0			0
14			1	1	1	0	0			0
15			1	1	1	0	0			0
16			1	1	1	0	0			0
17			1	1	1	0	0			0
18			1	1	1	0	0			0
19			1	1	1	0	0			0
20			1	1	1	0	0			0
21			1	1	1	0	0			0
22			1	1	1	0	0			0
23			1	1	1	0	0			0
24			1	1	1	0	0			0
25			1	1	1	0	0			0
26			1	1	1	0	0			0
27			1	1	1	0	0			0
28			1	1	1	0	0			0
29			1	1	1	0	0			0
30			1	1	1	0	0			0
31			1	1	1	0	0			0
32			1	1	1	0	0			0
33			1	1	1	0	0			0
34			1	1	1	0	0			0
35			1	1	1	0	0			0
	LRU TOTALS					0				0

( ) Required inputs
[ ] Calculated numbers

Unscheduled Other Subsystem/Maintenance Events Sheet

This sheet holds information on the unscheduled maintenance events associated with the miscellaneous subsystem/maintenance events. The subsystems/maintenance events that should be included in this table include oil filters, igniter plugs, borescope inspections, and so on. Table 11 shows the Unscheduled Other Subsystem/Maintenance Events Sheet. The inputs required for this sheet are listed below. The entry location for each input is shown on table 11.

1. Other subsystem/maintenance event names
2. Other subsystem/maintenance unscheduled baseline maintenance event rate (events per 1000 engine flight hours)
3. Event rate ratio
4. Probability of an unscheduled other subsystem/maintenance event affecting the inherent maintenance event rate
5. Probability of an unscheduled other subsystem/maintenance event affecting the other subsystem removal rate
6. Probability of an unscheduled other subsystem/maintenance event affecting the line replaceable unit removal rate
7. Probability of an unscheduled other subsystem/maintenance event affecting the shop visit rate
8. Probability of an unscheduled other subsystem/maintenance event affecting the in-flight shut down rate
9. Probability of an unscheduled other subsystem/maintenance event affecting the non-recoverable in-flight shut down rate
10. Number of other subsystem/maintenance events with a common event rate
11. Average organizational level maintenance man-hours per other subsystem/maintenance event (100% efficiency)
12. Average organizational level maintenance man-hours per line replaceable unit removal event (100% efficiency)

13. Average organizational level maintenance man-hours per shop visit event (100% efficiency)

14. Maintenance man-hour efficiency factor.

The sheet has seven columns that contain calculated data. The location of each column is indicated on table 11. The equations for each column are listed below.

1. Contribution of the other subsystem/maintenance events to the inherent maintenance event rate (events per 1000 engine flight hours)

Other subsystem/ maintenance unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled other subsystem/ maintenance event affecting the inherent maintenance event	X	Number of other subsystem/ maintenance events with a common event rate

2. Contribution of the other subsystem/maintenance events to the other subsystem/maintenance event rate

Other subsystem/ maintenance unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled other subsystem/ maintenance event affecting the other sub- system/maintenance event rate	X	Number of other subsystem/ maintenance events with a common event rate

3. Contribution of the other subsystem/maintenance events to the line replaceable unit removal rate (events per 1000 engine flight hours)

Other subsystem/ maintenance unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled other subsystem/ maintenance event affecting the line replaceable unit event rate	X	Number of other subsystem/ maintenance events with a common event rate

4. Contribution of the other subsystem/maintenance events to the shop visit rate (events per 1000 engine flight hours)

Other subsystem/ maintenance unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled other subsystem maintenance event affecting the shop visit rate	X	Number of other subsystem/ maintenance events with a common event rate

5. Contribution of the other subsystem/maintenance events to the in-flight shut down rate (events per 1000 engine flight hours)

Other subsystem/ maintenance unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled other subsystem/ maintenance event affecting in-flight shut down rate	X	Number of other subsystem/ maintenance events with a common event rate

6. Contribution of the other subsystem/maintenance events to the non-recoverable in-flight shut down rate (events per 1000 engine flight hours)

Other subsystem/ maintenance unscheduled baseline maintenance event rate	X	Event rate ratio	X	Probability of an unscheduled other subsystem/ maintenance event affecting non-recoverable in-flight shut down rate	X	Number of other subsystem/ maintenance events with a common event rate

7. Contribution of the other subsystem/maintenance events to the maintenance man-hours per engine flight hour.

[Contribution of the other subsystem/maintenance events to the other subsystem/maintenance event rate] X [Average organizational level maintenance man-hours per other subsytem/maintenance event]

\+

[Contribution of the other subsystem/maintenance events to the line replaceable unit removal rate] X [Average organizational level maintenance man-hours per line replaceable unit removal event]

\+

[Contribution of the other subsystem/maintenance events to the shop visit rate] X [Average organizational level maintenance man-hours per shop visit event]

X [maintenance man-hour efficiency factor] ÷ [1000]

This sheet will sum the data contained in the following columns:

1. Contribution of the other subsystem/maintenance events to the inherent maintenance event rate

2. Contribution of the other subsystem/maintenance events to the other subsystem/maintenance event rate

3. Contribution of the other subsystem/maintenance events to the line replaceable unit removal rate

4. Contribution of the other subsystem/maintenance events to the shop visit rate

5. Contribution of the other subsystem/maintenance events to the in-flight shut down rate

6. Contribution of the other subsystem/maintenance events to the non-recoverable in-flight shut down rate

7. Contribution of the other subsystem/maintenance events to the maintenance man-hours per engine flight hour.

TABLE 11. Unscheduled Other Subsystem/Maintenance Events

	UNSCHEDULED OTHER SUBSYSTEM\MAINTENANCE EVENTS																				
	OTHER SUBSYSTEM\MAINTENANCE EVENTS	OTHER EVENT UNSCHEDULED BASELINE MAINTENANCE EVENT RATE (EVENT/1K EFH)	EVENT RATE RATIO	PROBABILITY OF UNSCHEDULED OTHER EVENT AFFECTING EACH PARAMETER						NUMBER OF OTHER EVENTS WITH COMMON EVENT RATE	CONTRIBUTION OF OTHER EVENT TO EACH PARAMETER (EVENTS/1K EFH)						AVERAGE ORG-LEVEL UNSCHEDULED MMH PER EVENT (100% EFFICIENCY)			MMH EFFICIENCY FACTOR	CONTRI-BUTION OF OTHER EVENT TO MMH/EFH
				MI	OTHER	LRU	SVR	IPSD	NRIPSD		MI	OTHER	LRU	SVR	IPSD	NRIPSD	OTHER	LRU	SVR		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	[1]	[2]	[3]	[4]	[5]	[6]	(11)	(12)	(13)	(14)	[7]
1																					
2																					
3																					
4																					
5			1								0	0	0	0	0	0					0
6			1								0	0	0	0	0	0					0
7			1								0	0	0	0	0	0					0
8			1								0	0	0	0	0	0					0
9			1								0	0	0	0	0	0					0
10			1								0	0	0	0	0	0					0
11			1								0	0	0	0	0	0					0
12			1								0	0	0	0	0	0					0
13			1								0	0	0	0	0	0					0
14			1								0	0	0	0	0	0					0
15			1								0	0	0	0	0	0					0
16			1								0	0	0	0	0	0					0
17			1								0	0	0	0	0	0					0
18			1								0	0	0	0	0	0					0
19			1								0	0	0	0	0	0					0
20			1								0	0	0	0	0	0					0
21			1								0	0	0	0	0	0					0
22			1								0	0	0	0	0	0					0
23			1								0	0	0	0	0	0					0
24			1								0	0	0	0	0	0					0
25			1								0	0	0	0	0	0					0
26			1								0	0	0	0	0	0					0
27			1								0	0	0	0	0	0					0
28			1								0	0	0	0	0	0					0
29			1								0	0	0	0	0	0					0
30			1								0	0	0	0	0	0					0
31			1								0	0	0	0	0	0					0
32			1								0	0	0	0	0	0					0
33			1								0	0	0	0	0	0					0
34			1								0	0	0	0	0	0					0
35			1								0	0	0	0	0	0					0
	OTHER MAINTENANCE TOTALS										0	0	0	0	0	0					0

( ) Required inputs
[ ] Calculated numbers

Scheduled Other Subsystem/Maintenance Events Sheet

This sheet holds information on the scheduled maintenance events associated with the miscellaneous subsystem/maintenance events. The subsystem/maintenance events that should be included in this table include oil filters, igniter plugs, borescope inspections, and so on. Table 12 shows the Scheduled Other Subsystem/Maintenance Events Sheet.

The inputs required for this sheet are listed below. The entry location for each input is shown on table 12.

1. Other subsystem/maintenance event names
2. Other subsystem/maintenance scheduled baseline maintenance event rate (events per 1000 engine flight hours)
3. Event rate ratio
4. Scheduled event type - other subsystem/maintenance
5. Scheduled event type - maintenance man-hour events
6. Average organizational level maintenance man-hours per event (100% efficiency)
7. Maintenance man-hour efficiency factor.

This sheet has three columns that contain calculated data. The location of each column is indicated on table 12. The equations for each column are listed below.

1. Contribution of the other subsystem/maintenance events to the scheduled subsystem/maintenance event rate (events per 1000 engine flight hours)

$$\boxed{\begin{array}{l}\text{Other subsystem/}\\ \text{maintenance scheduled}\\ \text{baseline maintenance}\\ \text{event rate}\end{array}} \times \boxed{\begin{array}{l}\text{Event}\\ \text{rate}\\ \text{ratio}\end{array}} \times \boxed{\begin{array}{c}\text{Scheduled event type}\\ \text{(other subsystem/}\\ \text{maintenance)}\end{array}}$$

2. Contribution of the other subsystem/maintenance events to the scheduled maintenance man-hour event rate

Other subsystem/ maintenance scheduled baseline maintenance event rate	X	Event rate ratio	X	Scheduled event type (maintenance man-hour)

3. Contribution of the other subsystem/maintenance events to the scheduled maintenance man-hours per engine flight hour.

Contribution of the other subsystem/ maintenance events to the scheduled maintenance man-hour event rate	X	Average organizational level maintenance man-hours per event	X	Maintenance man-hour efficiency factor	÷	1000

This sheet will sum the data contained in the following columns:

1. Contribution of the other subsystem/maintenance events to the scheduled other subsystem/maintenance event rate

2. Contribution of the other subsystem/maintenance events to the scheduled maintenance man-hours per engine flight hour.

TABLE 12. Scheduled Other Subsystem/Maintenance Events

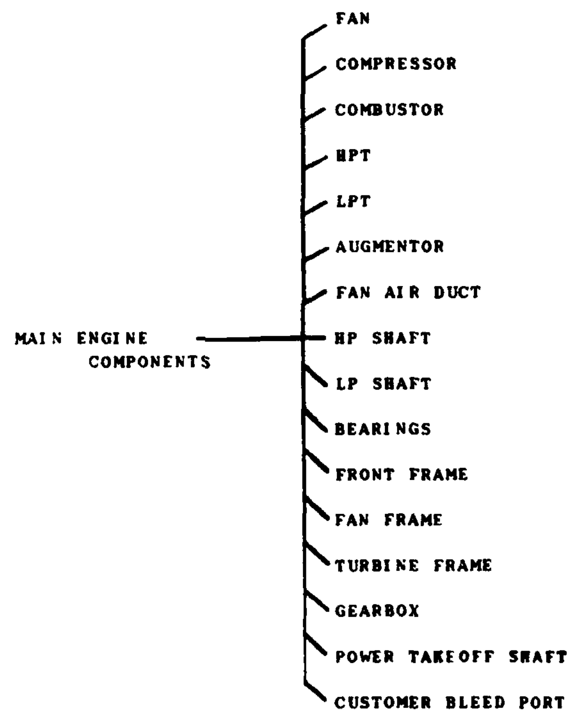
SCHEDULED OTHER SUBSYSTEM\MAINTENANCE EVENTS										
	OTHER SUBSYSTEM\MAINTENANCE EVENTS	OTHER EVENT SCHEDULED BASELINE MAINTENANCE EVENT RATE (EVENT/1K EFH)	EVENT RATE RATIO	SCHEDULED EVENT TYPE		CONTRIBUTION OF EACH OTHER EVENT TO SCHEDULED ORG LEVEL EVENTS (EVENT/1K EFH)		AVERAGE ORG LEVEL MMH PER EVENT 100% EFFICIENCY	MMH EFFICIENCY FACTOR	CONTRIBUTION OF OTHER EVENT TO SCHEDULED O-LEVEL MMH/EFH
				OTHER	MMH	OTHER	MMH			
1										
2	(1)	(2)	(3)	(4)	(5)	[1]	[2]	(6)	(7)	[3]
3										
4										
5			1		1	0	0			0
6			1		1	0	0			0
7			1		1	0	0			0
8			1		1	0	0			0
9			1		1	0	0			0
10			1		1	0	0			0
11			1		1	0	0			0
12			1		1	0	0			0
13			1		1	0	0			0
14			1		1	0	0			0
15			1		1	0	0			0
16			1		1	0	0			0
17			1		1	0	0			0
18			1		1	0	0			0
19			1		1	0	0			0
20			1		1	0	0			0
21			1		1	0	0			0
22			1		1	0	0			0
23			1		1	0	0			0
24			1		1	0	0			0
25			1		1	0	0			0
26			1		1	0	0			0
27			1		1	0	0			0
28			1		1	0	0			0
29			1		1	0	0			0
30			1		1	0	0			0
31			1		1	0	0			0
32			1		1	0	0			0
33			1		1	0	0			0
34			1		1	0	0			0
35			1		1	0	0			0
	OTHER MAINTENANCE TOTALS					0				0

( ) Required inputs
[ ] Calculated numbers

APPENDIX C

COMMON MAIN ENGINE SYSTEM FLOW CHARTS

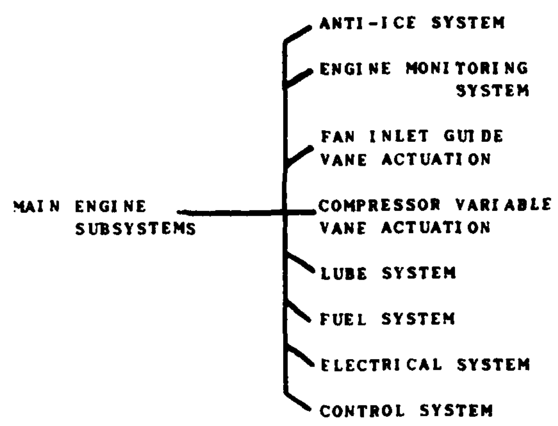
COMMON ENGINE-MAIN ENGINE COMPONENTS



COMMON ENGINE-MAIN ENGINE COMPONENT BREAK OUTS

- FAN
  - ROTOR ASSEMBLY
  - BLADES
  - STATOR VANES
- COMPRESSOR
  - ROTOR ASSEMBLY
  - BLADES
  - VARIABLE STATOR VANES
  - STATIONARY STATOR VANES
- COMBUSTOR
  - CASE
  - LINER
  - FUEL NOZZLES
  - SWIRLERS
- HPT
  - ROTOR ASSEMBLY
  - BLADES
  - SHROUD
  - NOZZLE
- LPT
  - ROTOR ASSEMBLY
  - BLADES
  - STATOR VANES
- AUGMENTOR
  - DUCT
  - LINER
  - MIXER
  - FLAME HOLDER
  - SPRAY BARS/SPRAY RINGS
- FRONT FRAME
  - FAN INLET VARIABLE VANES
  - FRAME STRUCTURE

COMMON ENGINE-MAIN ENGINE SUBSYSTEMS



COMMON ENGINE-MAIN ENGINE SUBSYSTEMS BREAK OUTS

- ANTI-ICE SYSTEM
  - ANTI-ICE VALVE
  - AIR LINES
  - ANTI-ICE VALVE ACTUATION
    - ACTUATOR
    - LINKAGE

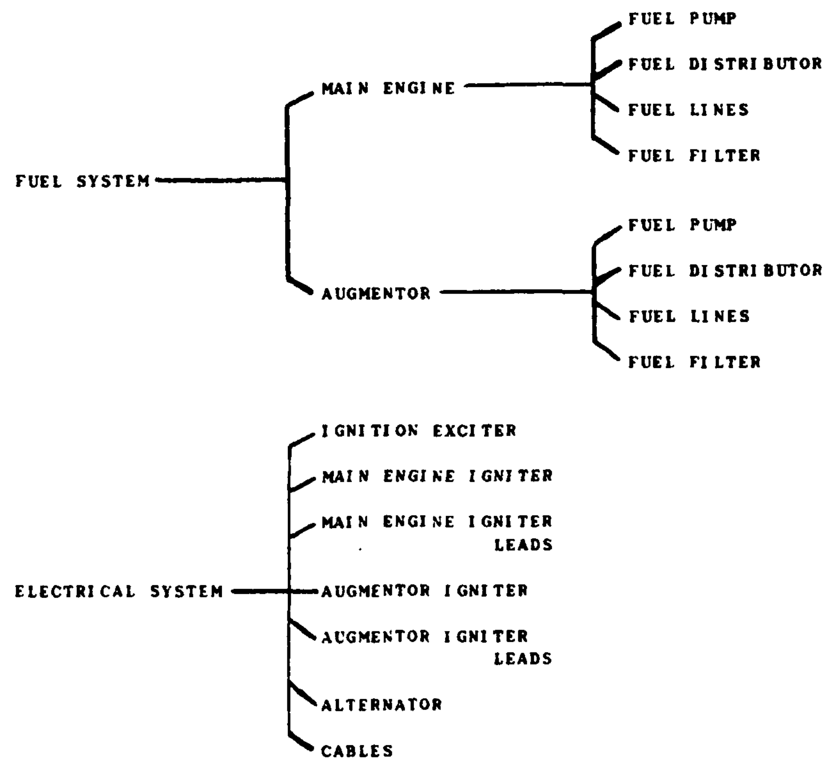
- ENGINE MONITORING SYSTEM
  - MONITORED PARAMETERS
    - ANTI-ICE SYSTEM STATUS
    - LUBE SYSTEM STATUS
    - FUEL SYSTEM STATUS
    - ELECTRICAL SYSTEM STATUS
    - CONTROL SYSTEM STATUS
    - ENGINE PERFORMANCE
    - ENGINE CYCLE COUNTER
    - ENGINE OPERATING TIME
    - AUGMENTOR OPERATING TIME
    - TURBINE TIME AT TEMPERATURE
    - ENGINE SENSOR STATUS

- FAN INLET GUIDE VANE ACTUATION
  - ACTUATOR
  - EHV
  - LINKAGE

- COMPRESSOR VARIABLE VANE ACTUATION
  - ACTUATOR
  - EHV
  - LINKAGE

- LUBE SYSTEM
  - LUBE PUMP
  - LUBE TANK
  - HEAT EXCHANGER
  - OIL JETS
  - OIL LINES
  - OIL SEALS
  - OIL FILTER
  - METAL CHIP DETECTOR

COMMON ENGINE-MAIN ENGINE SUBSYSTEM BREAK OUTS-(CONTINUED)



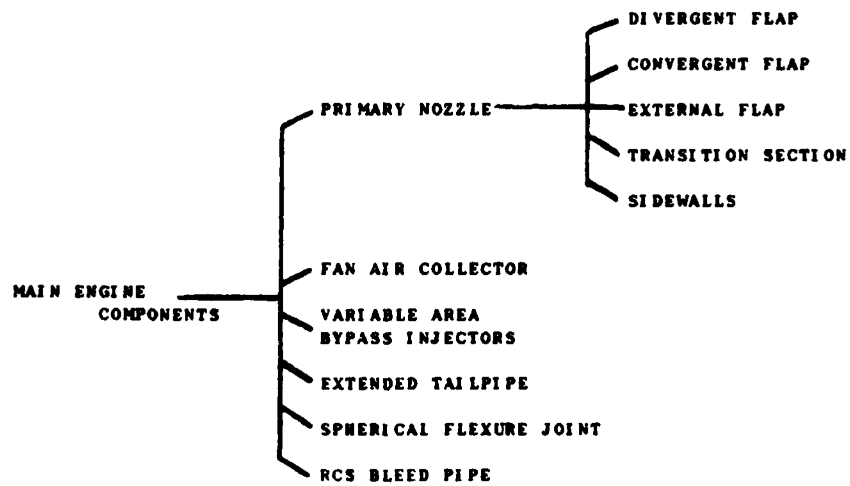
COMMON ENGINE-MAIN ENGINE SUBSYSTEMS BREAK OUTS-(CONTINUED)

- CONTROL SYSTEM
  - MAIN ENGINE FUEL CONTROL HYDROMECHANICAL
  - AUGMENTOR FUEL CONTROL HYDROMECHANICAL
  - SENSORS
    - ANTI-ICE VALVE LVDT
    - ANTI-ICE BLEED PRESSURE PROBE
    - FAN INLET GUIDE VANE LVDT
    - FAN EXIT PRESSURE PROBE
    - FAN INLET TEMPERATURE PROBE
    - COMPRESSOR VARIABLE VANE LVDT
    - COMPRESSOR INLET TEMPERATURE PROBE
    - COMPRESSOR DISCHARGE PRESSURE PROBE
    - COMPRESSOR EXIT TEMPERATURE PROBE
    - LUBE LEVEL INDICATOR
    - LUBE PRESSURE PROBE
    - LUBE TEMPERATURE PROBE
    - MAIN ENGINE FUEL VALVE LVDT
    - MAIN ENGINE FUEL FILTER INDICATOR
    - AUGMENTOR FUEL VALVE LVDT
    - AUGMENTOR FUEL FILTER INDICATOR
    - AUGMENTOR LIGHT-OFF DETECTOR
    - TURBINE BLADE PYROMETER
    - EXHAUST GAS TEMPERATURE PROBE
    - FAN SPEED SENSOR
    - CORE SPEED SENSOR
    - POWER LEVER ANGLE LVDT
    - ALTERNATOR POWER INDICATOR
  - COMPUTATION
    - ANTI-ICE VALVE POSITION
    - FAN VARIABLE VANE POSITION
    - COMPRESSOR VARIABLE VANE POSITION
    - MAIN ENGINE FUEL FLOW
    - AUGMENTOR FUEL FLOW
    - MAIN IGNITER INITIATION
    - AUGMENTOR IGNITER INITIATION
    - FAN SPEED
    - CORE SPEED
    - TURBINE BLADE TEMPERATURE

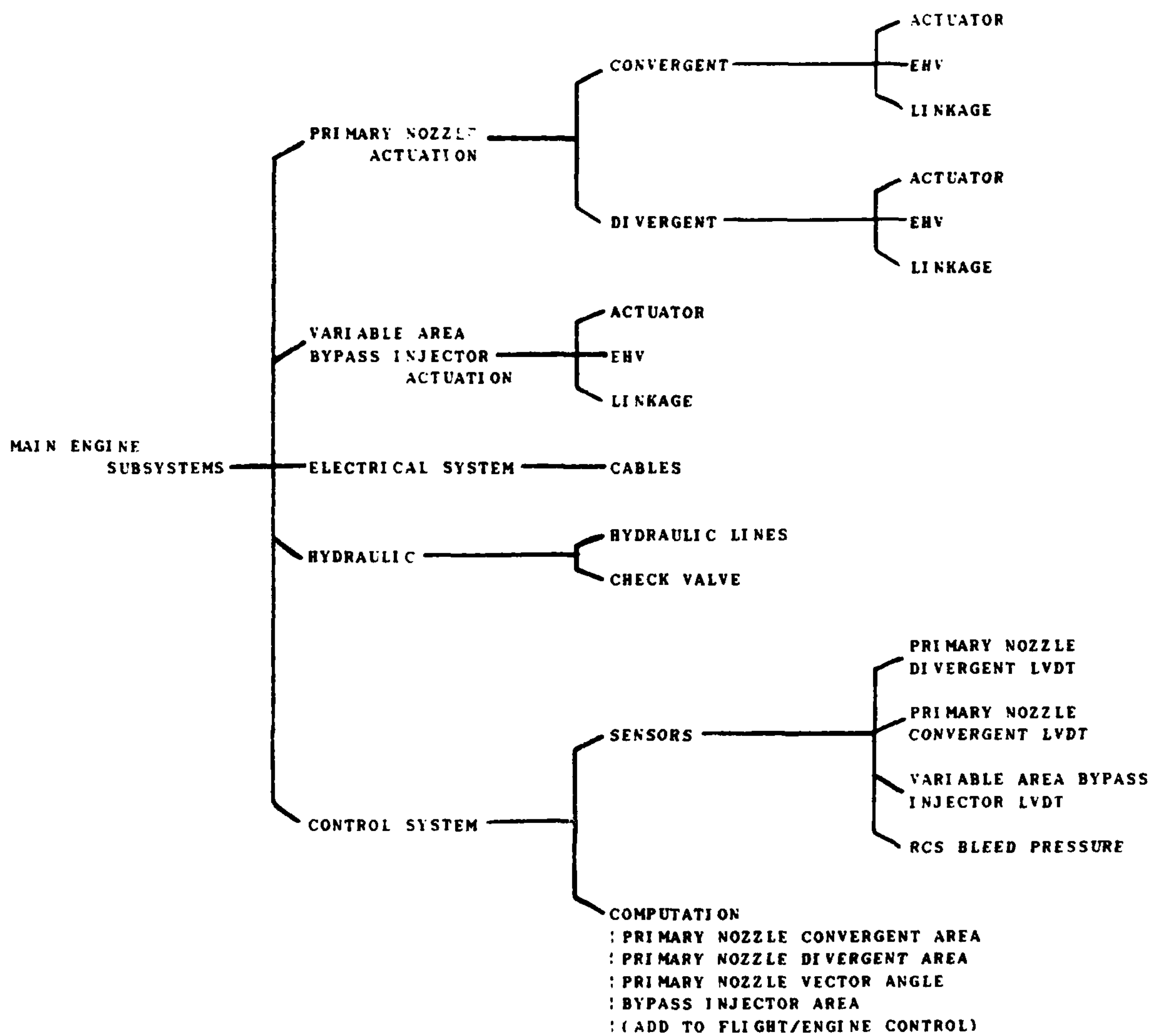
APPENDIX D

EJECTOR SYSTEM FLOW CHARTS

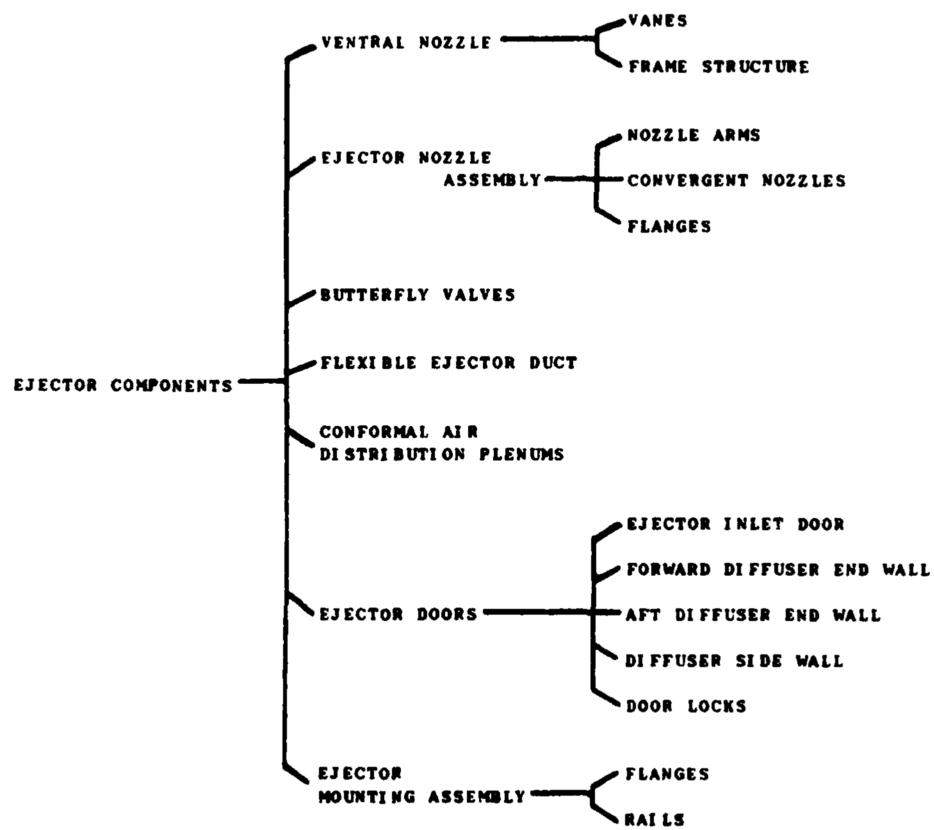
EJECTOR-MAIN ENGINE COMPONENTS



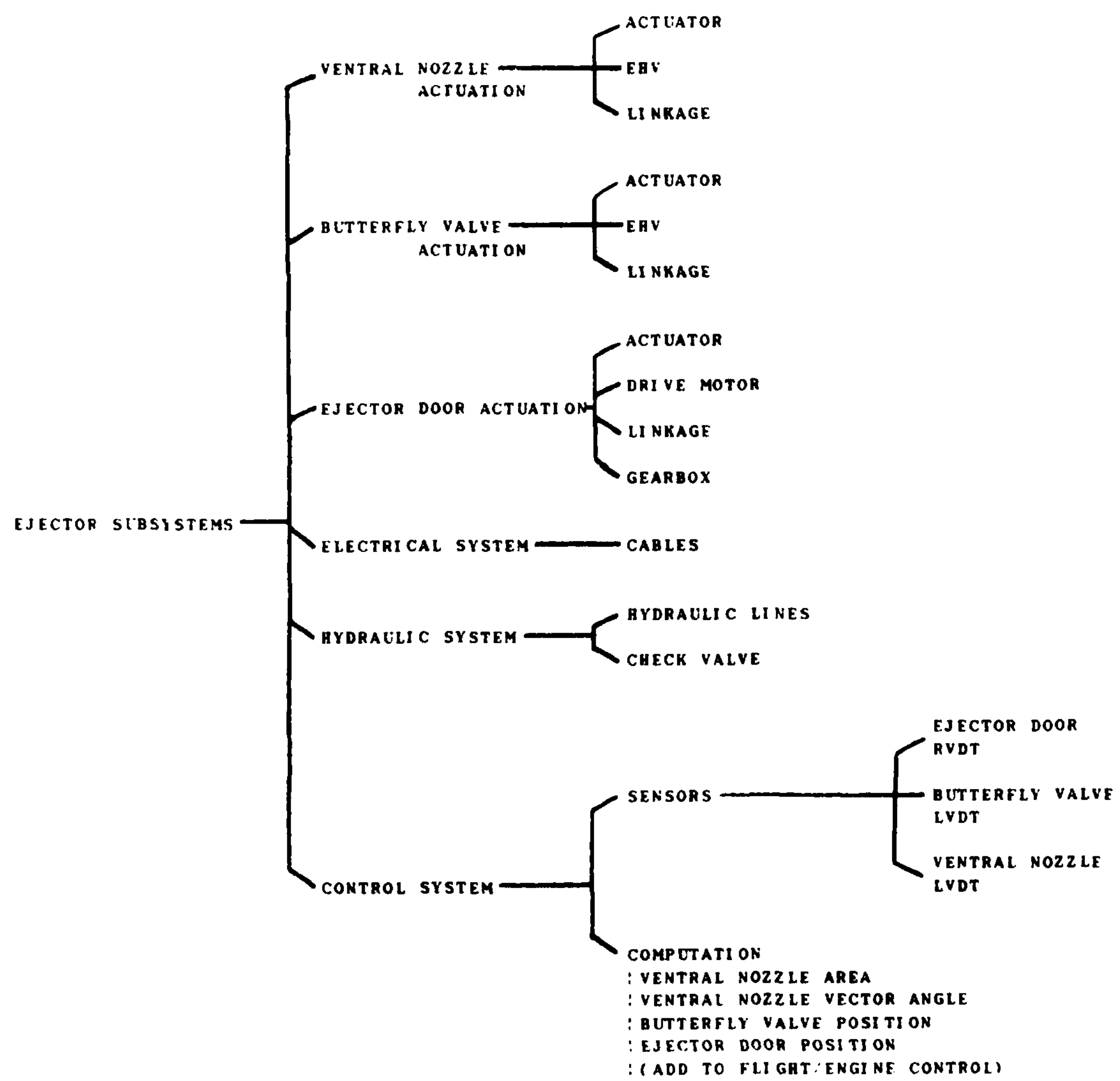
EJECTOR-MAIN ENGINE SUBSYSTEMS



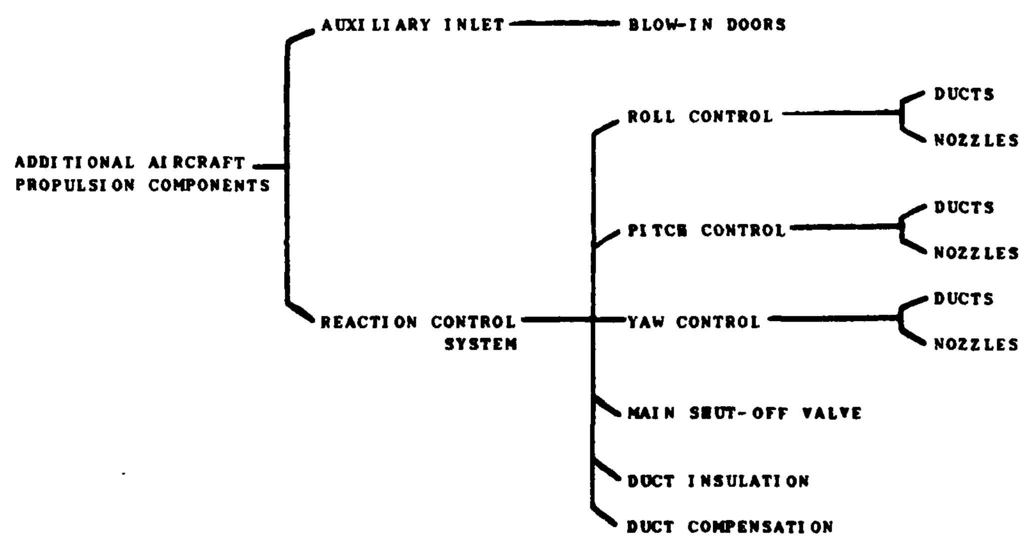
EJECTOR-COMPONENTS



EJECTOR-SUBSYSTEMS



EJECTOR-ADDITIONAL AIRCRAFT PROPULSION COMPONENTS



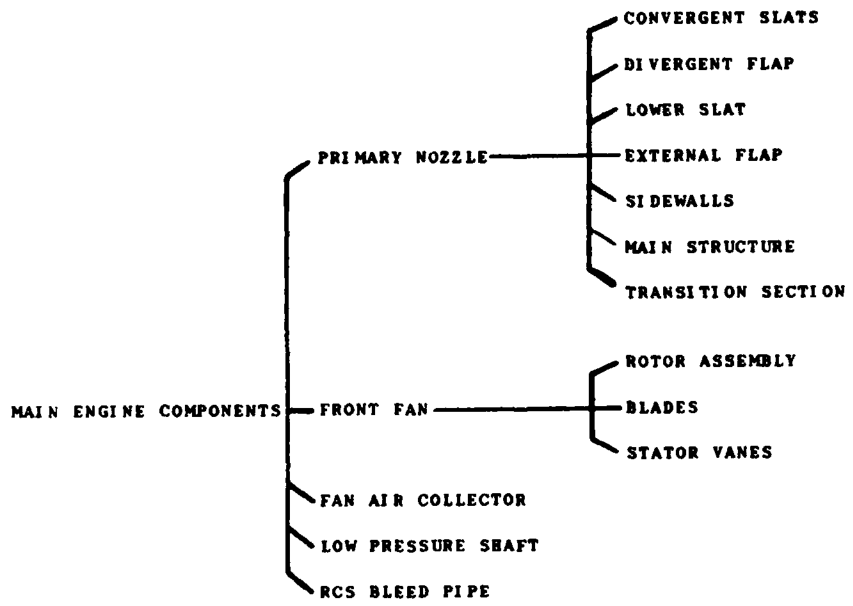
EJECTOR-ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEMS

- ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEMS
  - REACTION CONTROL SYSTEM ACTUATION
    - ROLL CONTROL NOZZLES
      - ACTUATOR
      - EHV
      - LINKAGE
    - PITCH CONTROL NOZZLES
      - ACTUATOR
      - EHV
      - LINKAGE
    - YAW CONTROL NOZZLES
      - ACTUATOR
      - EHV
      - LINKAGE
    - MAIN SHUT-OFF VALVE
      - ACTUATOR
      - EHV
      - LINKAGE
  - ELECTRICAL SYSTEM
    - CABLES
  - HYDRAULIC SYSTEM
    - HYDRAULIC LINES
    - CHECK VALVE
  - CONTROL SYSTEM
    - SENSORS
      - AUXILIARY INLET POSITION INDICATOR
      - RCS ROLL NOZZLE LVDT
      - RCS PITCH NOZZLE LVDT
      - RCS YAW NOZZLE LVDT
      - RCS MAIN SHUTOFF VALVE LVDT
    - COMPUTATION
      - :RCS BLEED FLOW
      - :RCS ROLL NOZZLE POSITION
      - :RCS PITCH NOZZLE POSITION
      - :RCS YAW NOZZLE POSITION
      - :(ADD TO FLIGHT/ENGINE CONTROL)

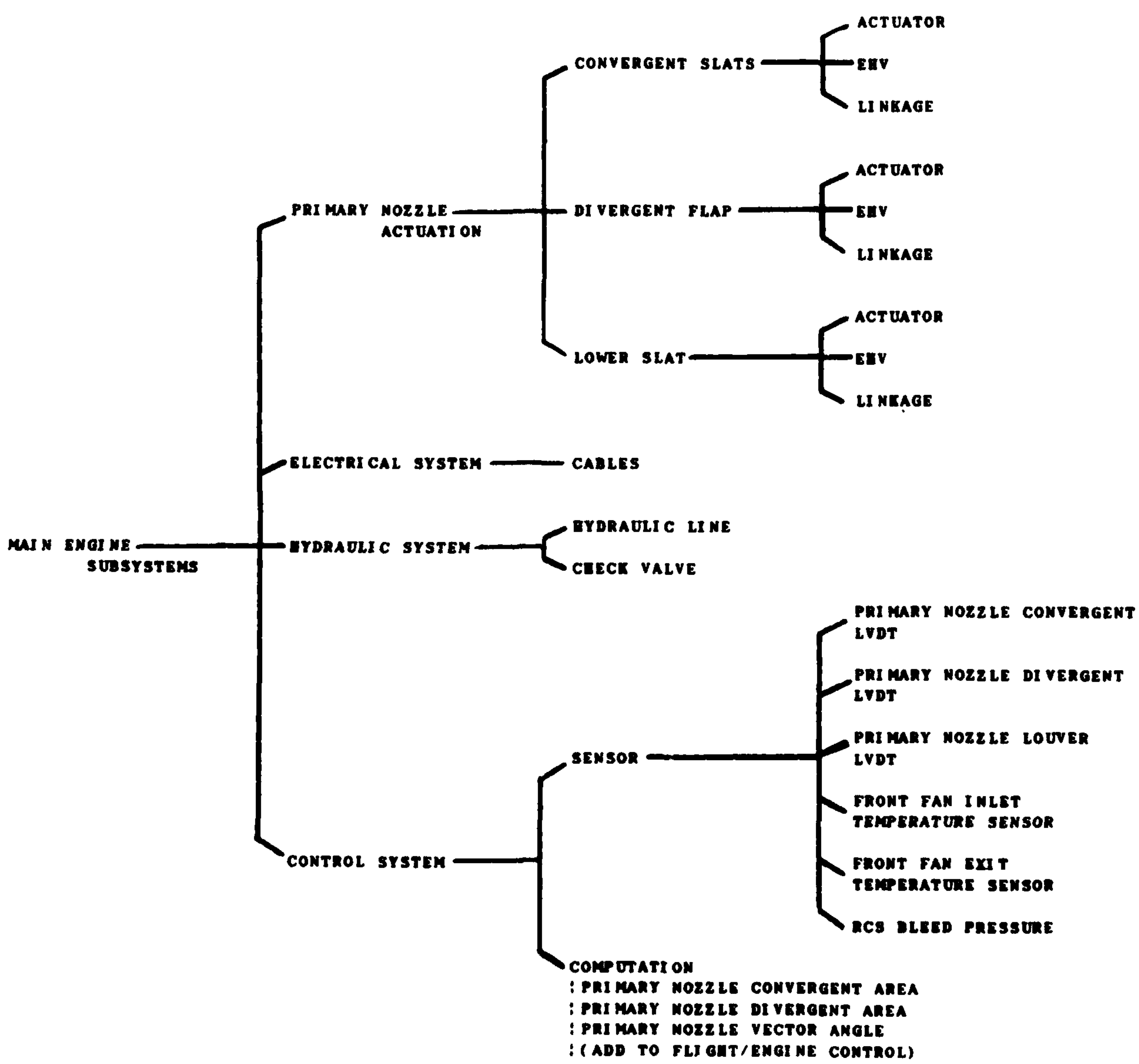
APPENDIX E

HFVT SYSTEM FLOW CHARTS

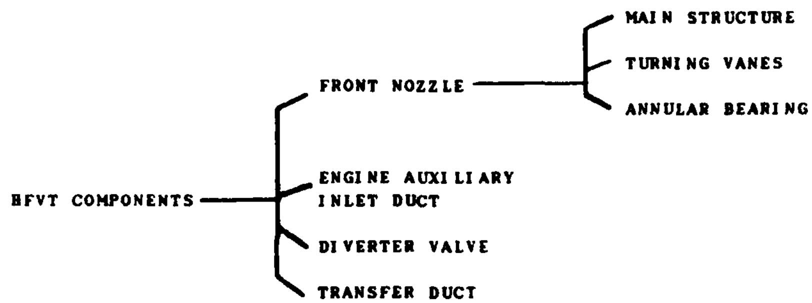
HFVT-MAIN ENGINE COMPONENTS



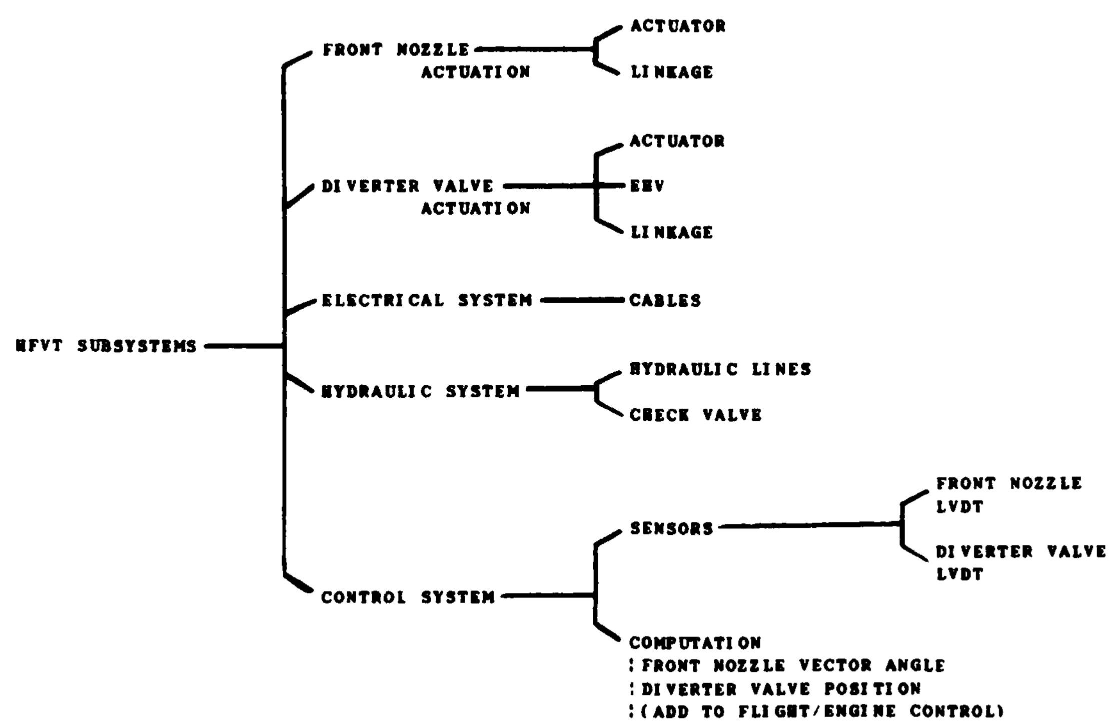
HVFT-MAIN ENGINE SUBSYSTEMS



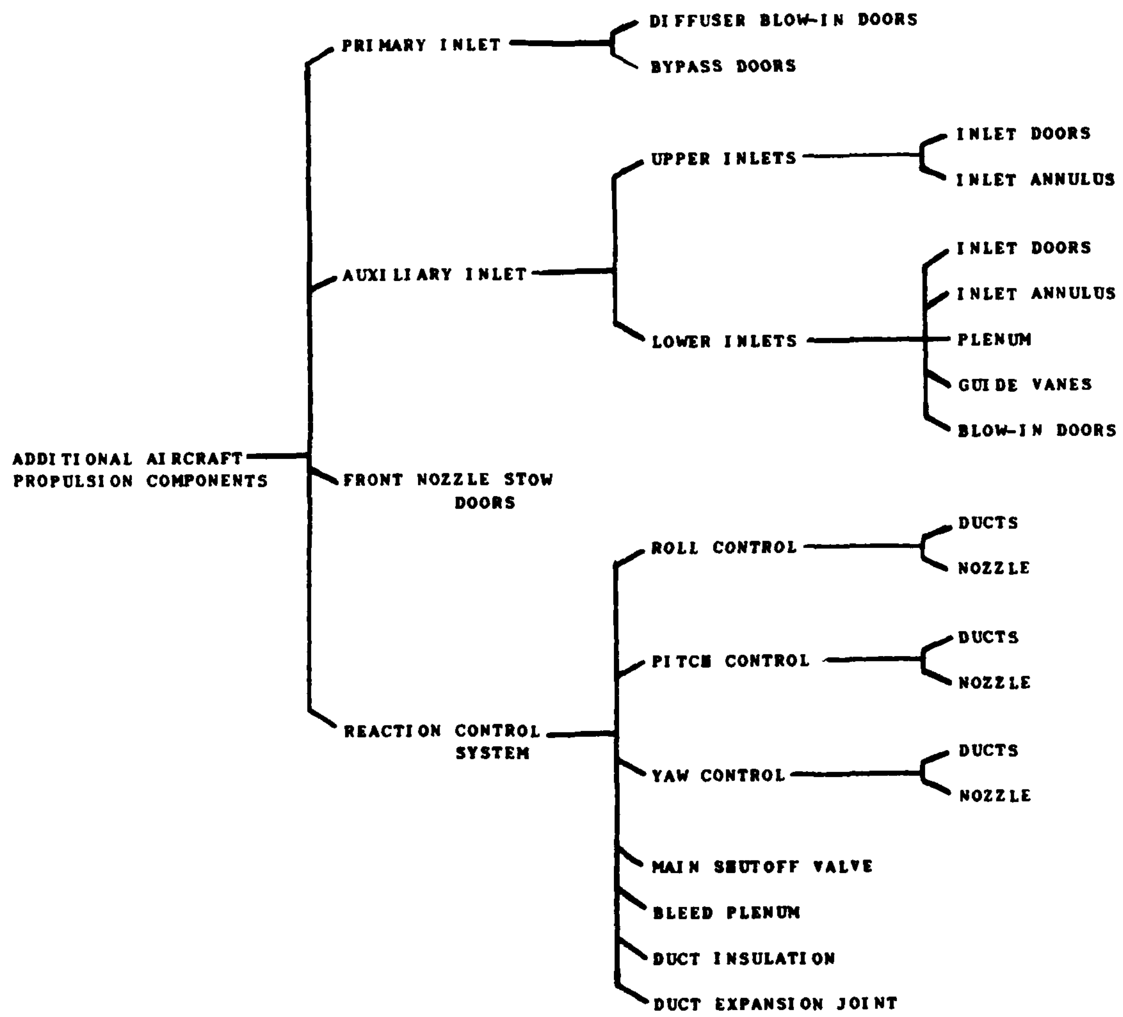
HFVT-COMPONENTS



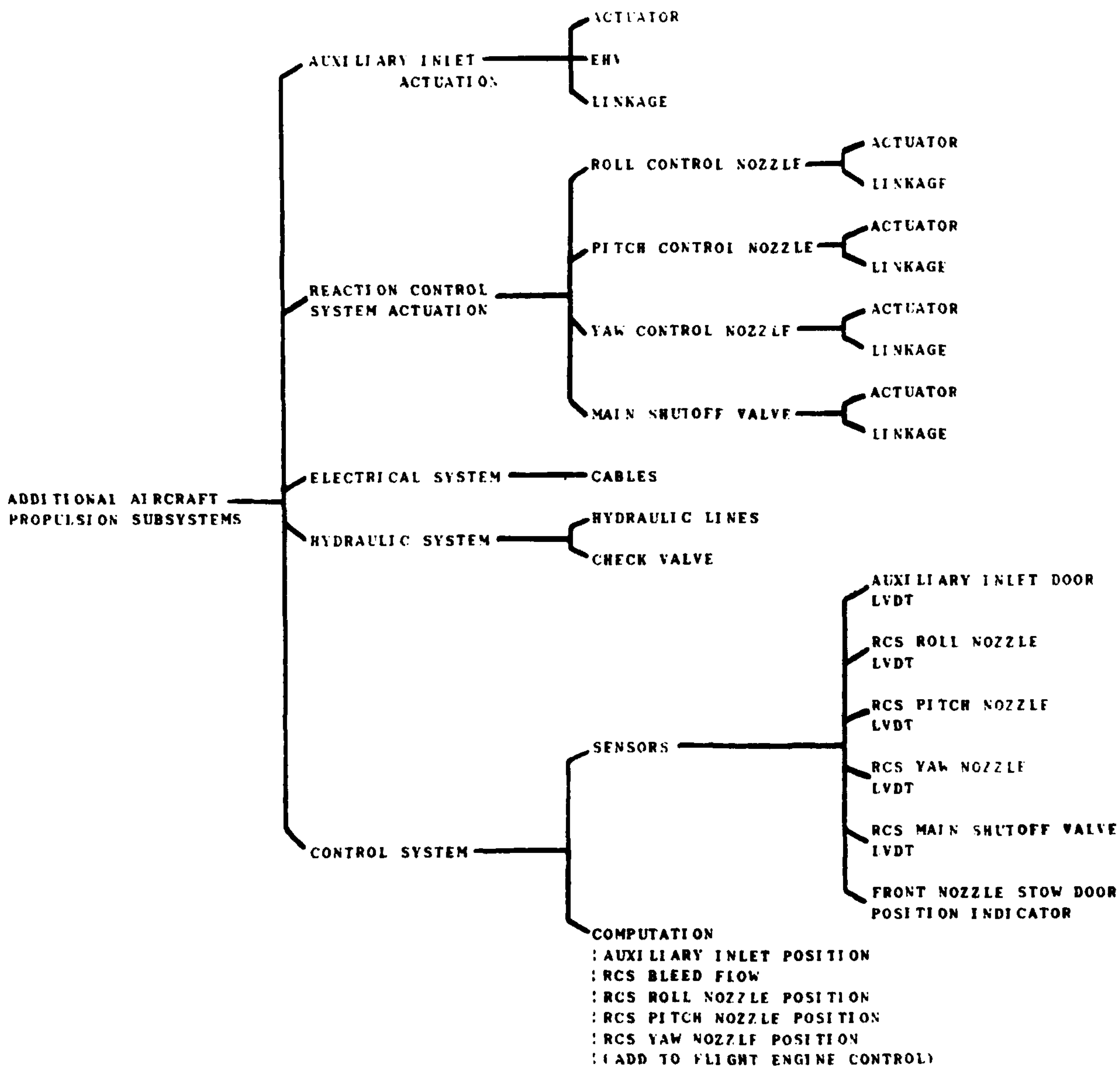
HFVT-SUBSYSTEMS



HFVT-ADDITIONAL AIRCRAFT PROPULSION COMPONENTS



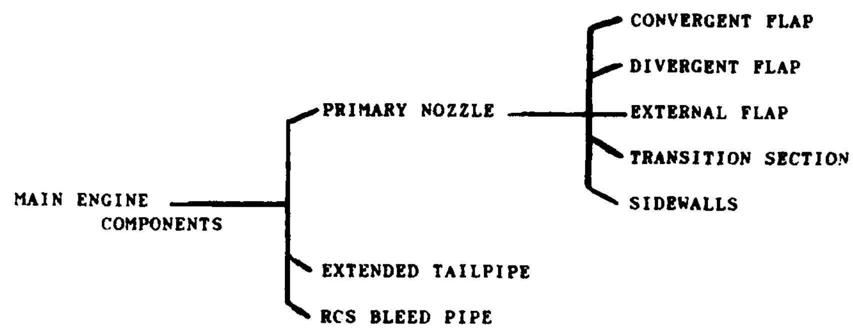
HEVT-ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEMS



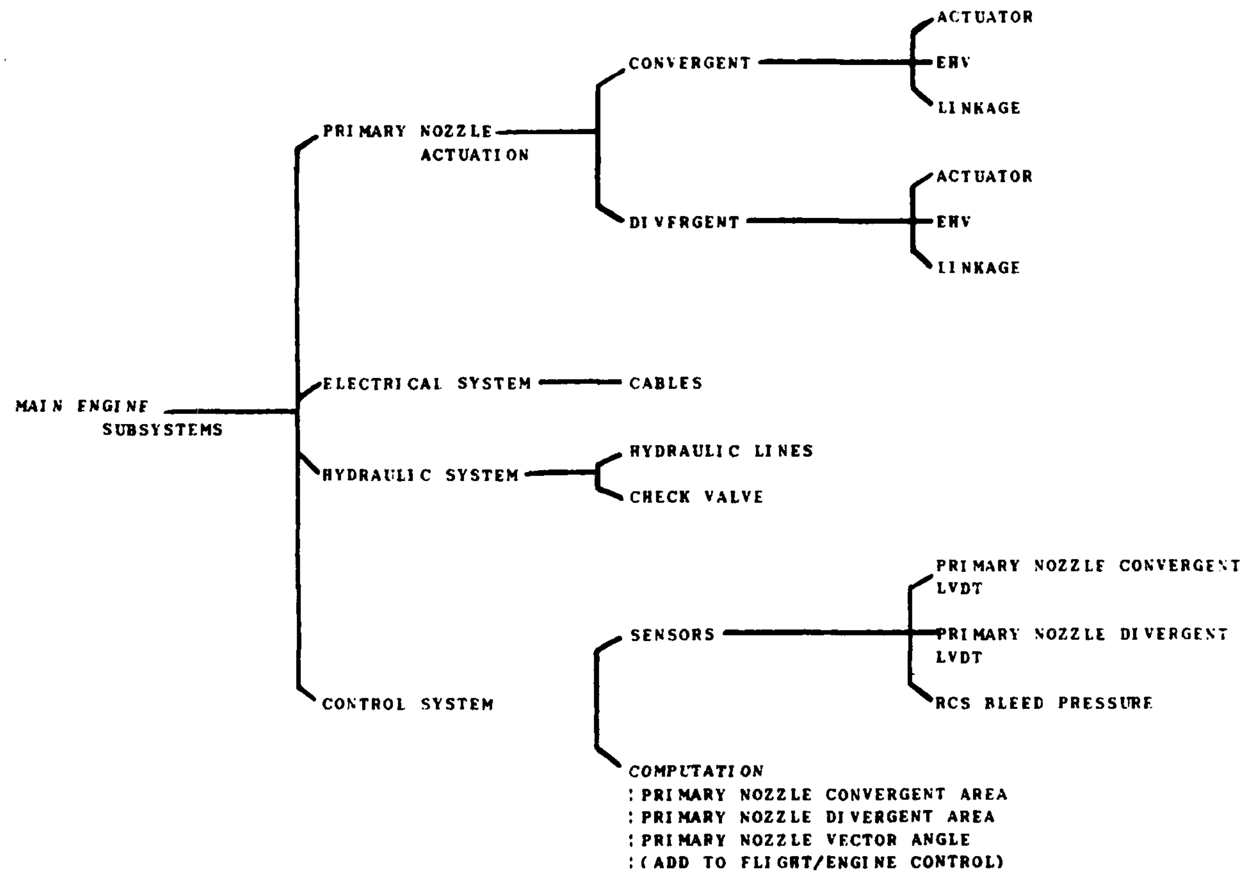
APPENDIX F

LIFT PLUS LIFT/CRUISE SYSTEM FLOW CHARTS

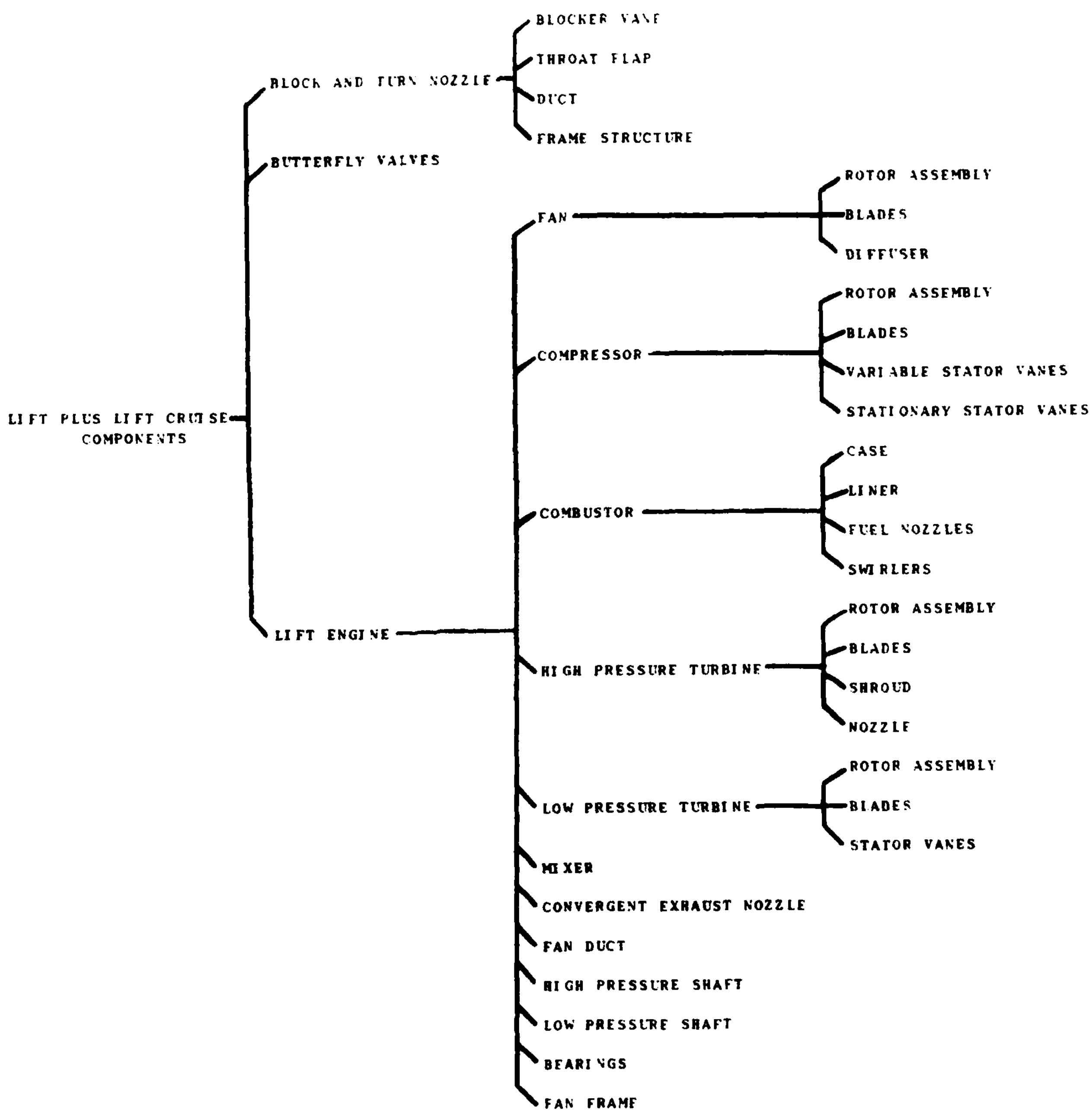
LIFT PLUS LIFT/CRUISE-MAIN ENGINE COMPONENTS



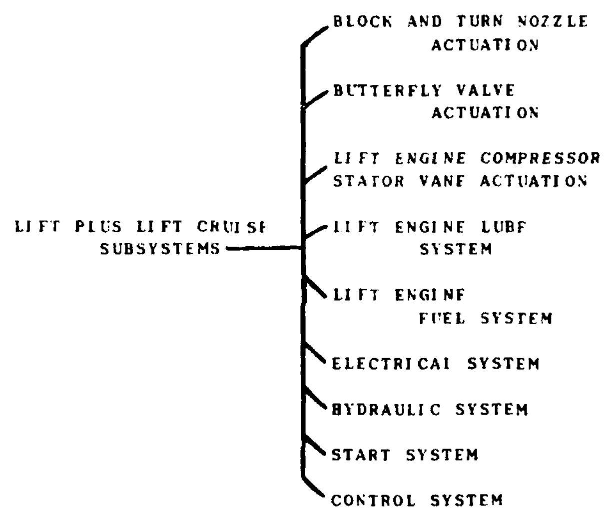
LIFT PLUS LIFT/CRUISE-MAIN ENGINE SUBSYSTEMS



LIFT PLUS LIFT/CRUISE-COMPONENTS



LIFT PLUS LIFT/CRUISE-SUBSYSTEMS



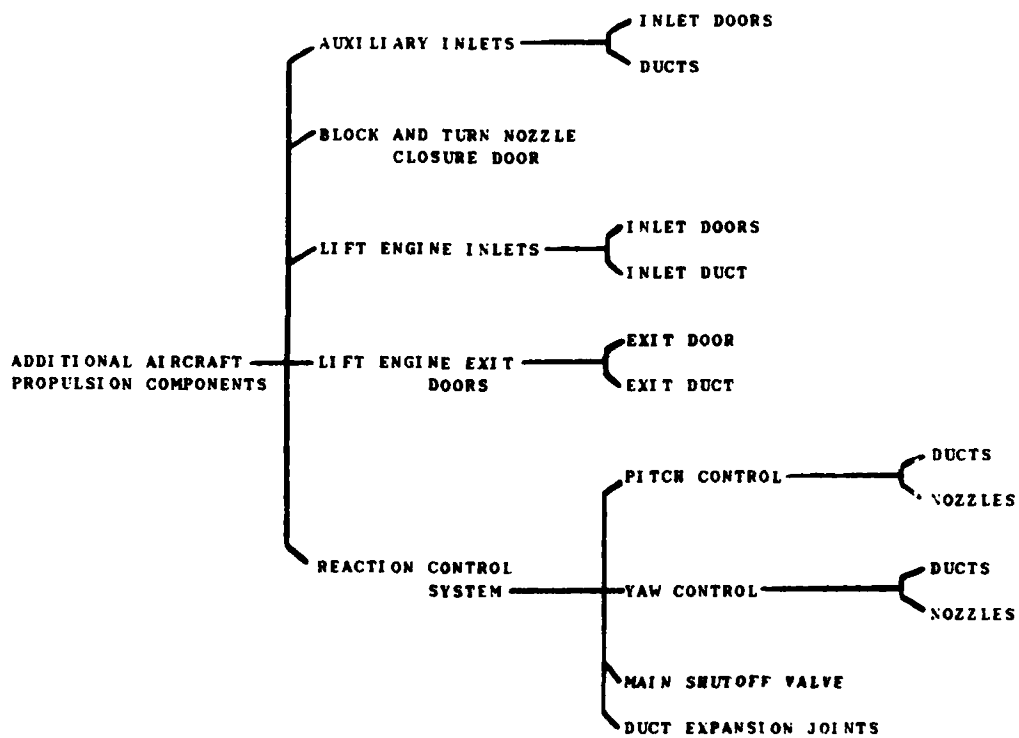
LIFT PLUS LIFT/CRUISE-SUBSYSTEM BREAK OUT

- BLOCK AND TURN NOZZLE ACTUATION
  - BLOCKER VANE
    - ACTUATOR
    - EHV
    - LINKAGE
  - THROAT FLAP
    - ACTUATOR
    - EHV
    - LINKAGE
- BUTTERFLY VALVE ACTUATION
  - ACTUATOR
  - EHV
  - LINKAGE
- LIFT ENGINE COMPRESSOR STATOR VANE ACTUATION
  - ACTUATOR
  - EHV
  - LINKAGE
- LIFT ENGINE LUBE SYSTEM
  - LUBE PUMP
  - LUBE TANK
  - OIL JETS
  - OIL LINES
  - OIL SEALS
  - OIL FILTER
- LIFT ENGINE FUEL SYSTEM
  - FUEL PUMP
  - FUEL DISTRIBUTOR
  - FUEL LINES
  - FUEL FILTER
- ELECTRICAL SYSTEM
  - LIFT ENGINE IGNITION EXCITER
  - LIFT ENGINE IGNITER
  - LIFT ENGINE IGNITER LEADS
  - CABLES

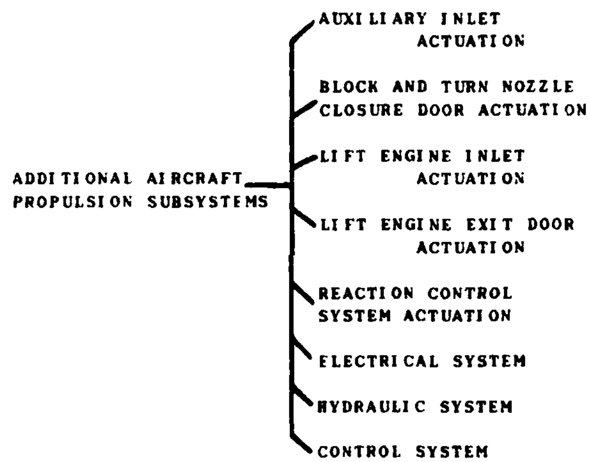
LIFT PLUS LIFT/CRUISE- SUBSYSTEM BREAK OUT (CONTINUED)

- HYDRAULIC SYSTEM
  - HYDRAULIC LINES
  - CHECK VALVE
- START SYSTEM
  - IMPINGEMENT LINE
- CONTROL SYSTEM
  - LIFT ENGINE FUEL CONTROL HYDROMECHANICAL
  - SENSORS
    - BLOCK AND TURN NOZZLE BLOCKER VANE LVDT
    - BLOCK AND TURN NOZZLE THROAT FLAP LVDT
    - BUTTERFLY VALVE LVDT
    - LIFT ENGINE COMPRESSOR VARIABLE VANE LVDT
    - LIFT ENGINE OIL PRESSURE SENSOR
    - LIFT ENGINE OIL LEVEL INDICATOR LEVEL INDICATOR
    - LIFT ENGINE OIL FILTER INDICATOR
    - LIFT ENGINE FUEL VALVE LVDT
    - LIFT ENGINE FUEL FILTER INDICATOR
    - LIFT ENGINE FAN INLET TEMP. SENSOR
    - LIFT ENGINE COMPRESSOR INLET TEMP. SENSOR
    - LIFT ENGINE COMPRESSOR DISCHARGE PRESSURE PROBE
    - LIFT ENGINE FAN SPEED SENSOR
    - LIFT ENGINE CORE SPEED SENSOR
    - LIFT ENGINE EXHAUST GAS TEMP. PROBE
    - LIFT ENGINE PROBE TURBINE BLADE PYROMETER
  - COMPUTATION
    - BLOCK AND TURN NOZZLE CONVERGENT AREA
    - BLOCK AND TURN NOZZLE FLAP POSITION
    - BUTTERFLY VALVE POSITION
    - LIFT ENGINE COMPRESSOR VARIABLE VANE POSITION
    - LIFT ENGINE FUEL FLOW
    - LIFT ENGINE IGNITER INITIATION
    - LIFT ENGINE IMPINGEMENT START AIR FLOW
    - FAN SPEED
    - CORE SPEED
    - TURBINE BLADE TEMPERATURE
    - (ADD TO FLIGHT/ENGINE CONTROL

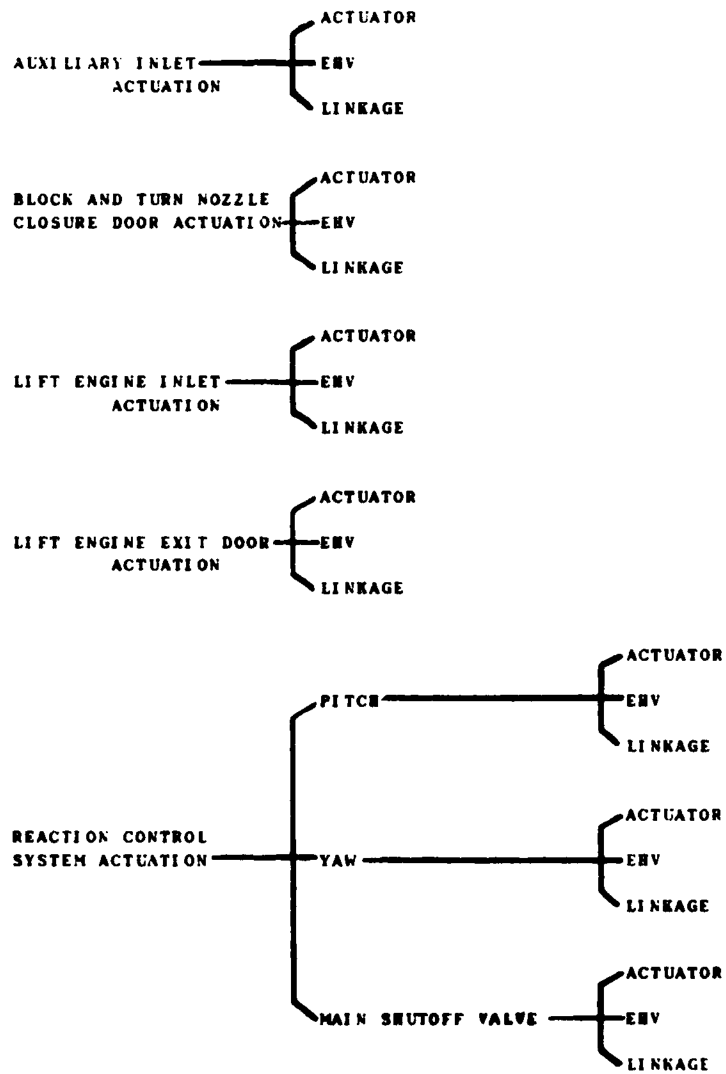
LIFT PLUS LIFT/CRUISE-ADDITIONAL AIRCRAFT PROPULSION COMPONENTS



LIFT PLUS LIFT/CRUISE-ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEMS



LIFT PLUS LIFT/CRUISE-ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEM BREAK OUT



LIFT PLUS LIFT/CRUISE-ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEM BREAK OUT (CONTINUED)

- ELECTRICAL SYSTEM
  - CABLES
- HYDRAULIC SYSTEM
  - HYDRAULIC LINES
  - CHECK VALVE
- CONTROL SYSTEM
  - SENSORS
    - AUXILIARY INLET DOOR LVDT
    - BLOCK AND TURN NOZZLE CLOSURE DOOR LVDT
    - LIFT ENGINE INLET DOOR LVDT
    - LIFT ENGINE EXIT DOOR LVDT
    - RCS PITCH NOZZLE LVDT
    - RCS YAW NOZZLE LVDT
    - MAIN SHUTOFF VALVE LVDT
  - COMPUTATION
    - : AUXILIARY INLET DOOR POSITION
    - : BLOCK AND TURN NOZZLE CLOSURE DOOR POSITION
    - : LIFT ENGINE INLET DOOR POSITION
    - : LIFT ENGINE EXIT DOOR POSITION
    - : RCS BLEED FLOW
    - : RCS PITCH NOZZLE POSITION
    - : RCS YAW NOZZLE POSITION
    - : (ADD TO FLIGHT/ENGINE CONTROL)

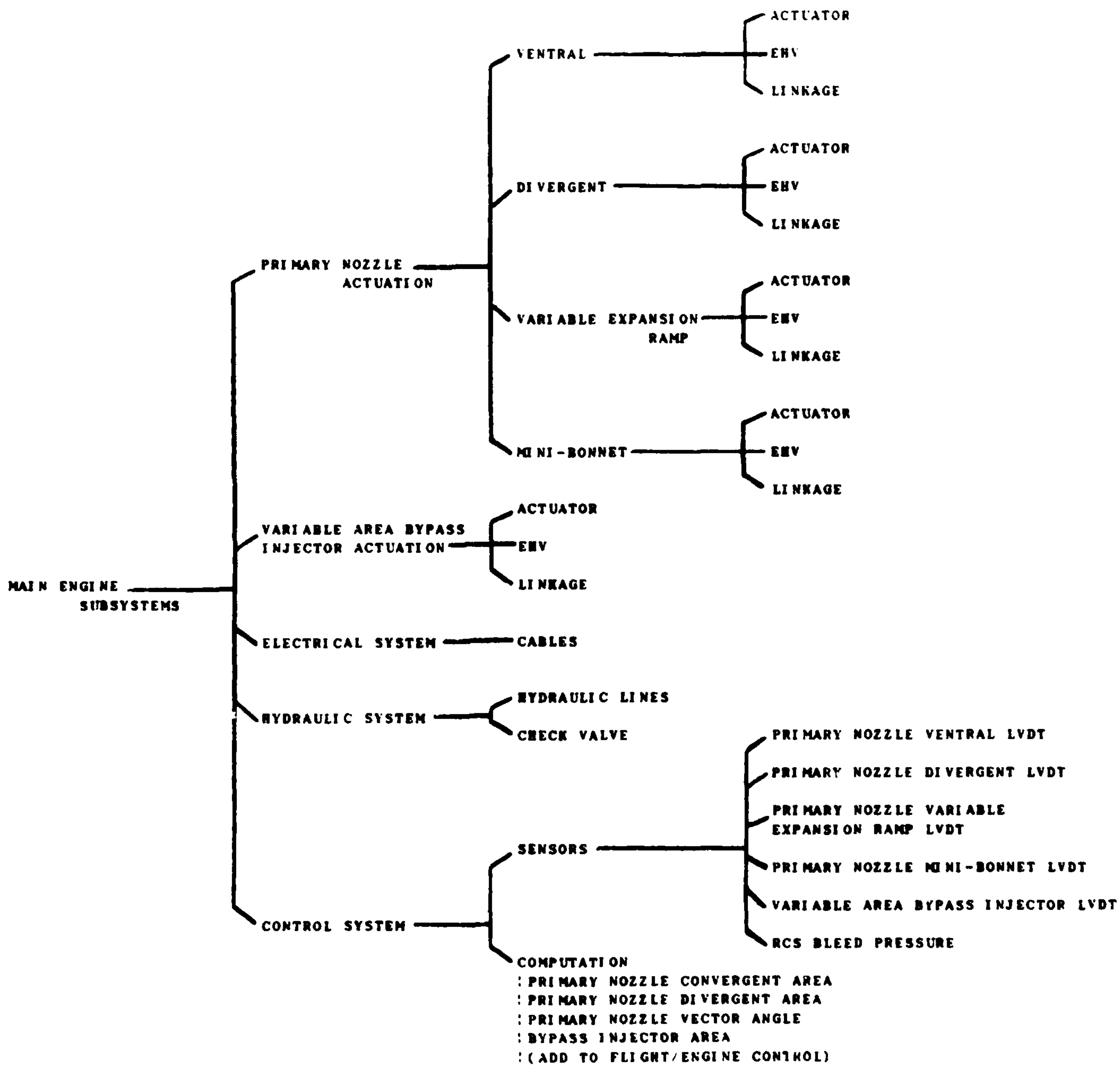
APPENDIX G

<u>RALS FLOW CHARTS</u>

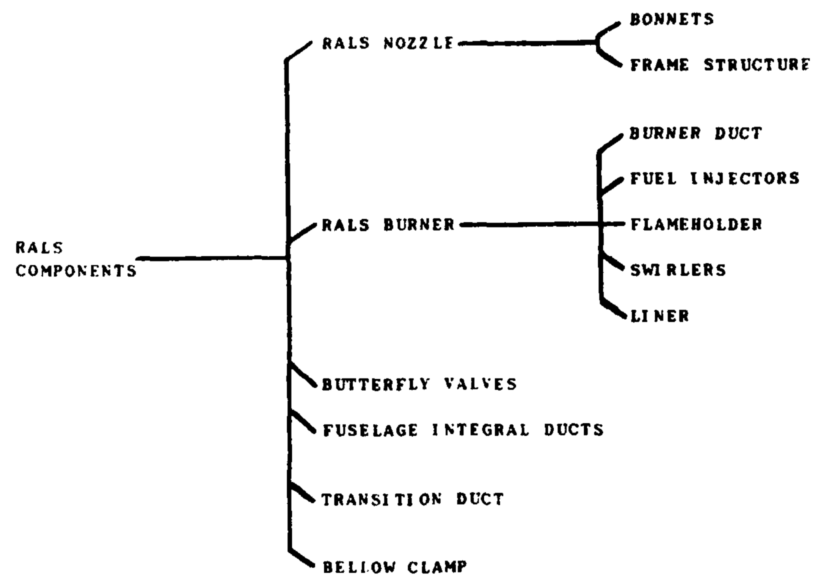
RALS-MAIN ENGINE COMPONENTS

- MAIN ENGINE COMPONENTS
  - PRIMARY NOZZLE SINGLE EXPANSION RAMP
    - VARIABLE EXPANSION RAMP
    - EXTERNAL FLAP
    - CONVERGENT FLAP
    - DIVERGENT FLAP
    - VENTRAL FLAP
    - TRANSITION SECTION
    - SIDEWALL
    - MINI-BONNET
  - FAN AIR COLLECTOR
  - VARIABLE AREA BYPASS INJECTORS
  - RCS BLEED PIPE

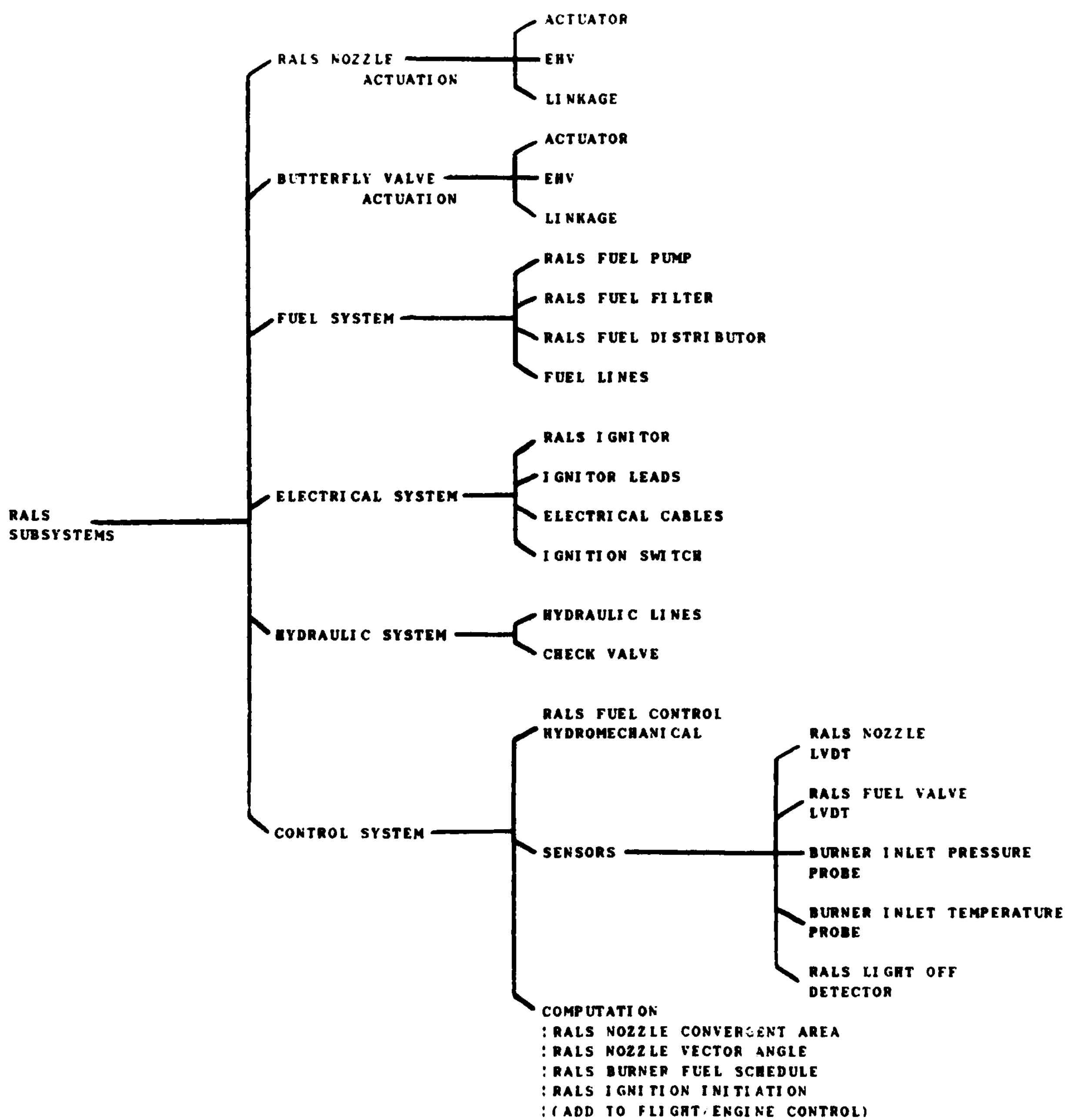
RALS-MAIN ENGINE SUBSYSTEMS



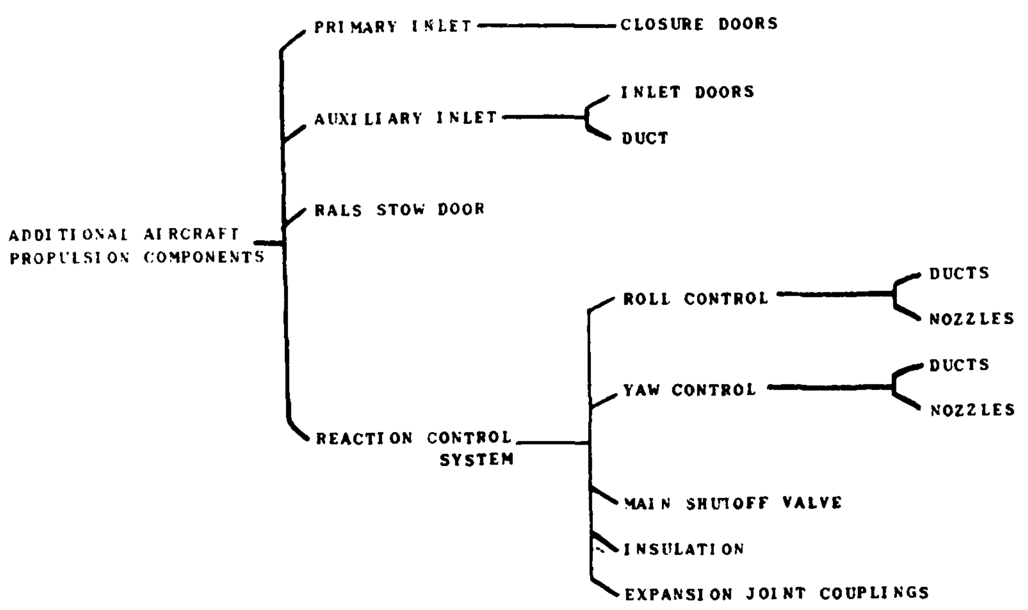
RALS-COMPONENTS



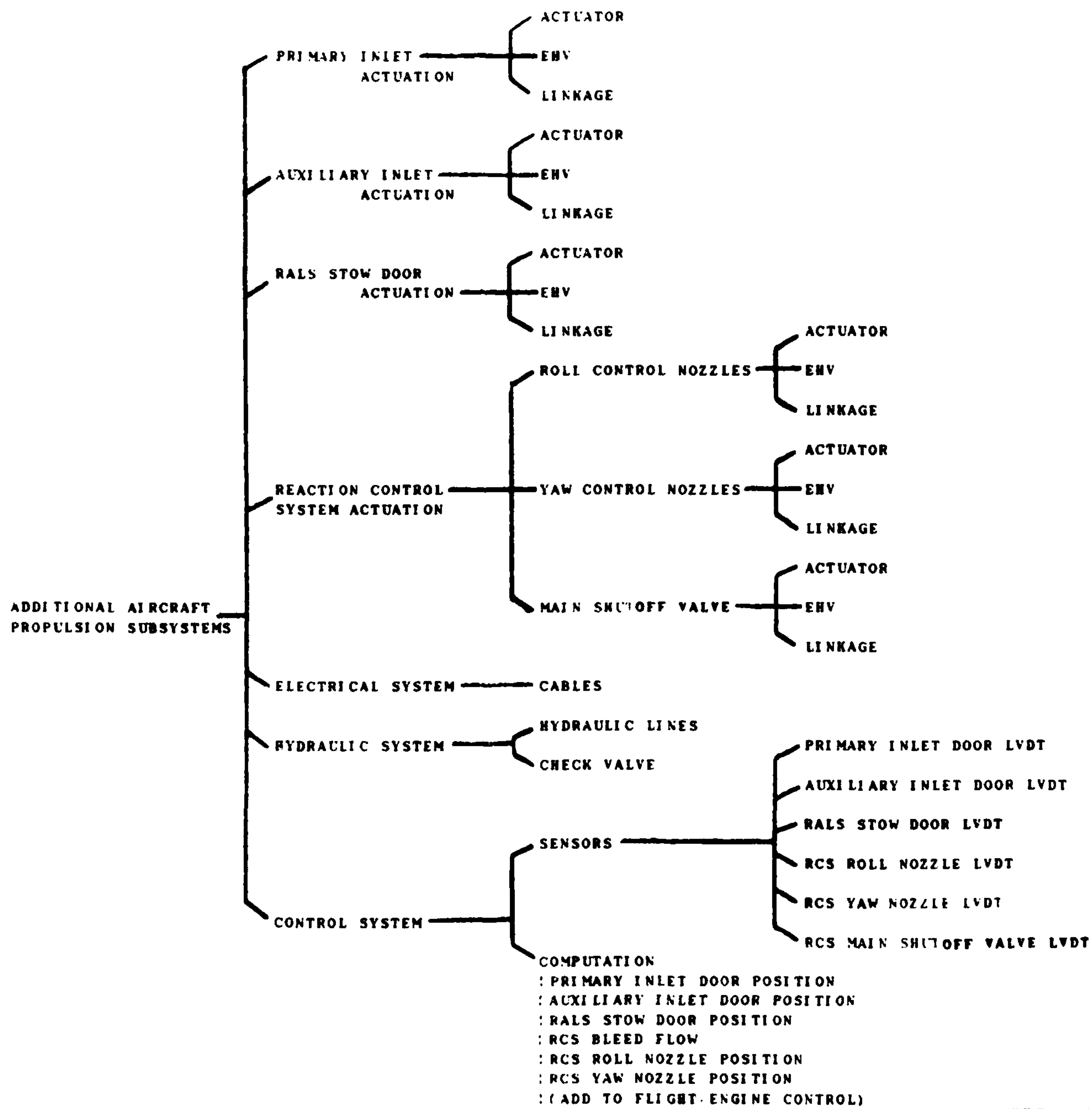
RALS-SUBSYSTEMS



RALS-ADDITIONAL AIRCRAFT PROPULSION COMPONENTS



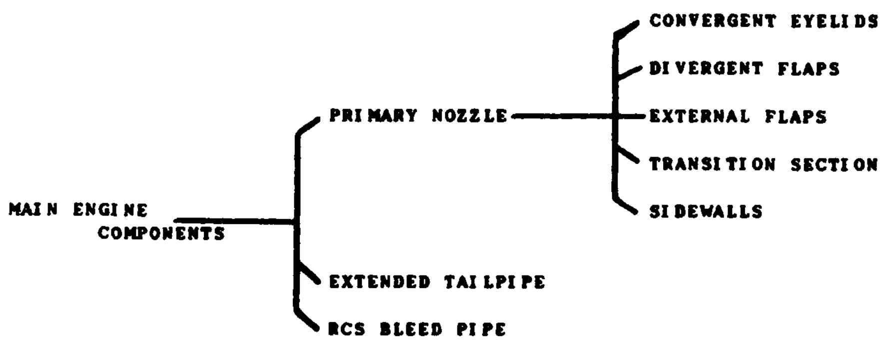
RALS-ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEMS



APPENDIX H

REX SYSTEM FLOW CHARTS

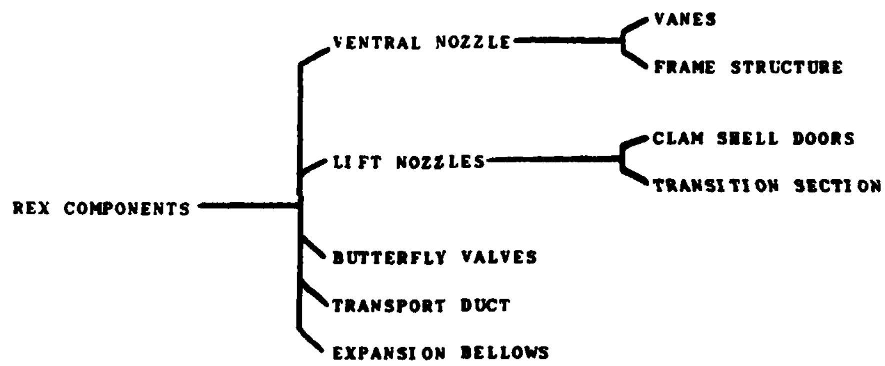
REX-MAIN ENGINE COMPONENTS



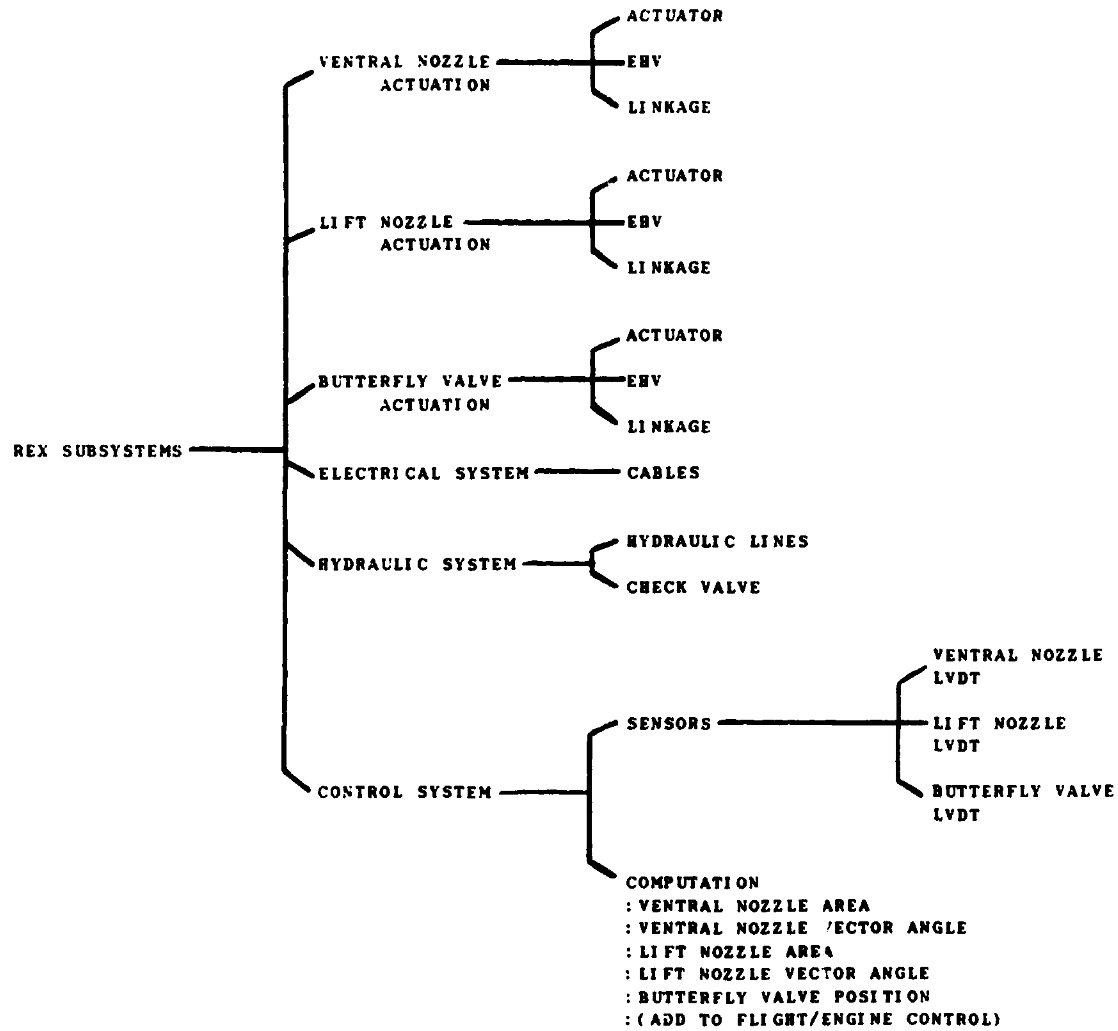
REX-MAIN ENGINE SUBSYSTEMS

- MAIN ENGINE SUBSYSTEMS
  - PRIMARY NOZZLE ACTUATION
    - CONVERGENT
      - ACTUATOR
      - EHV
      - LINKAGE
    - DIVERGENT
      - ACTUATOR
      - EHV
      - LINKAGE
  - ELECTRICAL SYSTEM
    - CABLES
  - HYDRAULIC SYSTEM
    - HYDRAULIC LINES
    - CHECK VALVE
  - CONTROL SYSTEM
    - SENSORS
      - PRIMARY NOZZLE DIVERGENT LVDT
      - PRIMARY NOZZLE CONVERGENT LVDT
      - RCS BLEED PRESSURE
    - COMPUTATION
      - :PRIMARY NOZZLE CONVERGENT AREA
      - :PRIMARY NOZZLE DIVERGENT AREA
      - :PRIMARY NOZZLE VECTOR ANGLE
      - :(ADD TO FLIGHT/ENGINE CONTROL)

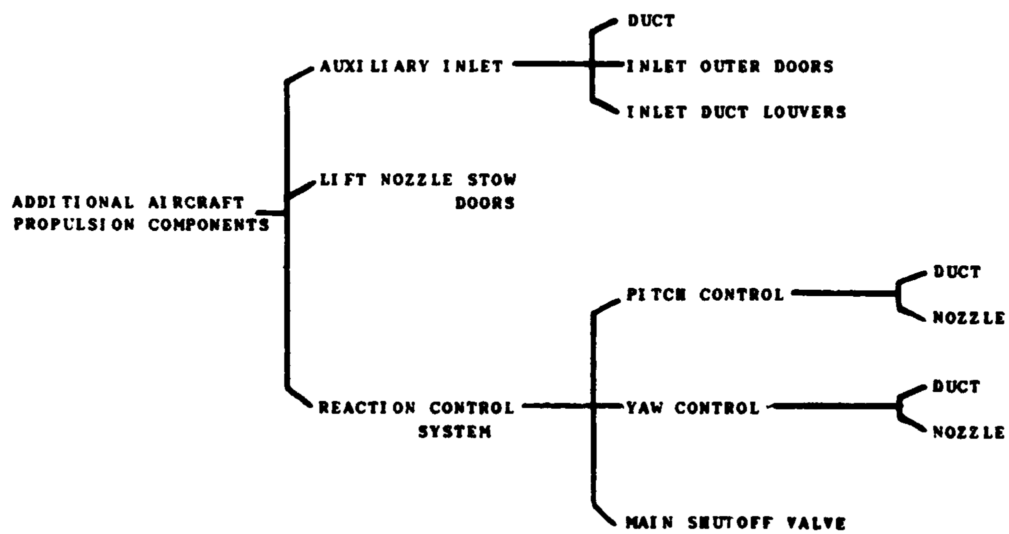
REX-COMPONENTS



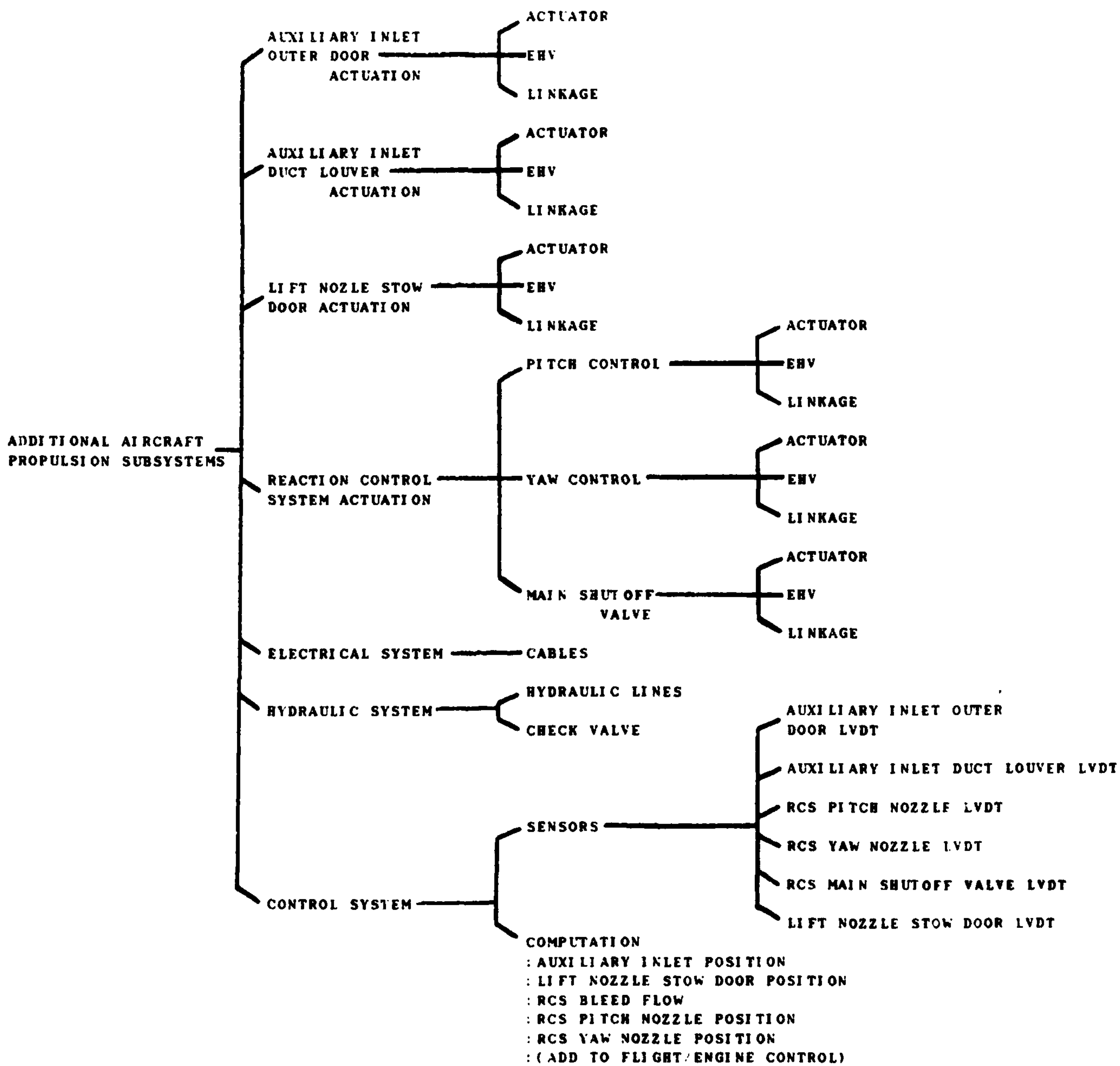
REX-SUBSYSTEMS



REX-ADDITIONAL AIRCRAFT PROPULSION COMPONENTS



REX-ADDITIONAL AIRCRAFT PROPULSION SUBSYSTEMS



APPENDIX I

RADA ANALYSIS

RESOURCE ALLOCATION DECISION AID

The Resource Allocation Decision Aid (RADA) software package is designed to rank the possible solutions to a problem. The possible solutions or alternatives are characterized by rating criteria. Up to five levels of criteria hierarchy can be defined in this program. Weights can be placed on the rating criteria. These weights can be applied directly to each criteria or set up in a pair-wise fashion to reflect the relationship between several criteria. Filters can be constructed for each criteria in order to normalize the raw data inputs. Sensitivity studies can be conducted by varying the filter and weight settings. The program will calculate an index and a rank for each alternative (CFC Incorporated. 1986).

In order to conduct a RADA analysis the following steps should be taken:

1. Define the alternatives
2. Define the rating criteria
3. Create a criteria hierarchy
4. Enter raw data for the criteria defined for each alternative
5. Choose a normalization method for each criterion (set filters)
6. Choose the weight to be applied to each criterion
7. Review the index ratings and alternatives rating calculated by the RADA program. Conduct sensitivity analyses if necessary and select the best alternative (CFC Incorporated, 1986).

TOP LEVEL

CRITERIA HIERARCHY

```
¦---C01 * MAIN ENGINE COMPONENTS
¦---C02 * MAIN ENGINE SUBSYSTEMS
¦---C03 * VERTICAL LIFT COMPONENTS
¦---C04 * VERTICAL LIFT SUBSYSTEMS
¦---C05 * AIRCRAFT COMPONENTS
¦---C06 * AIRCRAFT SUBSYSTEMS
```

TOP LEVEL RATINGS

MATRICES REPORT

NODE: TOP: TOP LEVEL

ALTERNATIVES (rows)	WTS=>	CRITERIA (in Columns) C01	C03	C05	C02	C04	C06	INDEX	RANK
		2	2	1	1	1	1		
A03 RALS		8	9	3	10	8	10	10	5
A02 LIFT+LIFT/CRUISE		1	10	6	1	10	10	6	4
A05 HFVT		10	1	10	6	1	6	5	3
A01 EJECTOR		6	8	1	6	5	1	4	2
A04 REX		1	6	2	1	4	10	1	1

C01 MAIN ENGINE COMPONENTS C03 VERTICAL LIFT COMPONENTS C05 AIRCRAFT COMPONENTS
C02 MAIN ENGINE SUBSYSTEMS C04 VERTICAL LIFT SUBSYSTEMS C06 AIRCRAFT SUBSYSTEMS

TOP LEVEL RAW DATA

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: TOP: TOP LEVEL

ALTERNATIVES (rows)	CRITERIA (in Columns) C01	C03	C05	C02	C04	C06
EJECTOR	6.0	8.0	1.0	6.0	5.0	1.0
LIFT+LIFT/CRUISE	1.0	10.0	6.0	1.0	10.0	10.0
RALS	8.0	9.0	3.0	10.0	8.0	10.0
REX	1.0	6.0	2.0	1.0	4.0	10.0
HFVT	10.0	1.0	10.0	6.0	1.0	6.0

C01 MAIN ENGINE COMPONENTS C03 VERTICAL LIFT COMPONENTS C05 AIRCRAFT COMPONENTS
C02 MAIN ENGINE SUBSYSTEMS C04 VERTICAL LIFT SUBSYSTEMS C06 AIRCRAFT SUBSYSTEMS

SECOND LEVEL CRITERIA HIERARCHY

```
¦---C07 * RELIABILITY
     ¦---C28 * COMPLEXITY
     ¦---C29 * PART COUNT
     ¦---C30 * TECHNOLOGY MATURITY
     ¦---C38 * PART ENVIRONMENT

¦---C08 * MAINTAINABILITY
     ¦---C31 * SERVICEABILITY
     ¦---C32 * TIME TO REPAIR
     ¦---C33 * REPARABILITY

¦---C09 * SUPPORTABILITY
     ¦---C34 * MAINTENANCE COSTS
     ¦---C35 * MAN-POWER
     ¦---C36 * REPLACEMENT PARTS
     ¦---C37 * SUPPORT EQUIPMENT
```

SECOND LEVEL OVERALL RATINGS

MATRICES REPORT

NODE: TOP: MAIN ENGINE COMPONENTS (MEC)

ALTERNATIVES (rows)	C07	C09	C08	INDEX	RANK
WTS=>	1	1	1		
A05 HFVT MEC	9	10	10	10	5
A03 RALS MEC	10	6	6	8	4
A01 EJECTOR MEC	5	5	8	6	3
A04 REX MEC	1	1	1	1	2
A02 LIFT+LIFT/CRUISE MEC	1	1	1	1	1

CRITERIA (in Columns)

C07 RELIABILITY C09 SUPPORTABILITY C08 MAINTAINABILITY

MATRICES REPORT

NODE: TOP: VERTICAL LIFT COMPONENTS (VLC)

ALTERNATIVES (rows)	C07	C09	C08	INDEX	RANK
WTS=>	1	1	1	10	5
A02 LIFT+LIFT/CRUISE VLC	10	10	10	10	5
A03 RALS VLC	10	7	10	9	4
A01 EJECTOR VLC	8	9	8	8	3
A04 REX VLC	7	4	6	6	2
A05 HFVT VLC	1	1	1	1	1

CRITERIA (in Columns)

C07 RELIABILITY C09 SUPPORTABILITY C08 MAINTAINABILITY

SECOND LEVEL OVERALL RATINGS (CONTINUED)

MATRICES REPORT

NODE: TOP: VERTICAL LIFT SUBSYSTEMS (VLS)

CRITERIA (in Columns)

ALTERNATIVES (rows)	C07	C09	C08	INDEX	RANK
WTS=>	1	1	1		
A02 LIFT+LIFT/CRUISE VLS	10	10	10	10	5
A03 RALS VLS	9	9	6	8	4
A01 EJECTOR VLS	7	4	4	5	3
A04 REX VLS	3	4	5	4	2
A05 HFVT VLS	1	1	1	1	1

C07 RELIABILITY　C09 SUPPORTABILITY　C08 MAINTAINABILITY

MATRICES REPORT

NODE: TOP: AIRCRAFT COMPONENTS (AC)

CRITERIA (in Columns)

ALTERNATIVES (rows)	C07	C09	C08	INDEX	RANK
WTS=>	1	1	1		
A05 HFVT AC	10	10	10	10	5
A02 LIFT+LIFT/CRUISE AC	7	6	5	6	4
A03 RALS AC	5	3	3	3	3
A04 REX AC	4	3	1	2	2
A01 EJECTOR AC	1	1	3	1	1

C07 RELIABILITY　C09 SUPPORTABILITY　C08 MAINTAINABILITY

MATRICES REPORT

NODE: TOP: AIRCRAFT SUBSYSTEMS (AS)

CRITERIA (in Columns)

ALTERNATIVES (rows)	C07	C09	C08	INDEX	RANK
WTS=>	1	1	1		
A02 LIFT+LIFT/CRUISE AS	10	10	10	10	5
A04 REX AS	8	10	8	9	4
A03 RALS AS	8	10	8	9	3
A05 HFVT AS	6	6	8	7	2
A01 EJECTOR AS	1	1	1	1	1

C07 RELIABILITY　C09 SUPPORTABILITY　C08 MAINTAINABILITY

SECOND LEVEL RATINGS - MAIN ENGINE COMPONENTS

MATRICES REPORT

NODE: C09: SUPPORTABILITY

ALTERNATIVES (rows)		CRITERIA (in Columns) C34	C35	C36	C37	INDEX	RANK
	WTS=>	2	2	1	1		
A05 HFVC MEC		10	10	10	1	10	5
A03 RALS MEC		6	7	4	1	6	4
A01 EJECTOR MEC		6	4	7	1	5	3
A04 REX MEC		1	1	1	1	1	2
A02 LIFT+LIFT/CRUISE MEC		1	1	1	1	1	1

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

MATRICES REPORT

NODE: C08: MAINTAINABILITY

ALTERNATIVES (rows)		CRITERIA (in Columns) C31	C32	C33	INDEX	RANK
	WTS=>	2	2	1		
A05 HFVT AC		10	10	6	10	5
A01 EJECTOR MEC		7	6	10	8	4
A03 RALS MEC		4	6	10	6	3
A04 REX MEC		1	1	1	1	2
A02 LIFT+LIFT/CRUISE MEC		1	1	1	1	1

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

MATRICES REPORT

NODE: C07: RELIABILITY

ALTERNATIVES (rows)		CRITERIA (in Columns) C28	C29	C30	C38	INDEX	RANK
	WTS=>	2	1	2	1		
A05 RALS MEC		7	7	10	10	10	5
A05 HFVT MEC		10	10	6	6	9	4
A01 EJECTOR MEC		4	4	6	1	5	3
A04 REC MEC		1	1	1	1	1	2
A02 LIFT+LIFT/CRUISE MEC		1	1	1	1	1	1

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RATINGS - MAIN ENGINE SUBSYSTEMS

MATRICES REPORT

NODE: C09: SUPPORTABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows) WTS=>	C34 2	C35 2	C36 1	C37 1	INDEX	RANK
A03 RALS MES	10	10	10	1	10	5
A05 HFVT MES	6	6	6	1	6	4
A01 EJECTOR MES	6	6	6	1	6	3
A04 REX MES	1	1	1	1	1	2
A02 LIFT+LIFT/CRUISE MES	1	1	1	1	1	1

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

MATRICES REPORT

NODE: C08: MAINTAINABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows) WTS=>	C31 2	C32 2	C33 1	INDEX	RANK
A03 RALS MES	10	10	10	10	5
A01 EJECTOR MES	6	7	10	7	4
A05 HFVT MES	6	4	10	6	3
A04 REX MES	1	1	1	1	2
A02 LIFT+LIFT/CRUISE MES	1	1	1	1	1

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

MATRICES REPORT

NODE: C07: RELIABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows) WTS=>	C28 2	C29 1	C30 2	C38 1	INDEX	RANK
A03 RALS MES	10	10	10	10	10	5
A05 HFVT MES	10	7	6	6	7	4
A01 EJECTOR MES	6	4	6	1	5	3
A04 REX MES	1	1	1	1	1	2
A02 LIFT+LIFT/CRUISE MES	1	1	1	1	1	1

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RATINGS - VERTICAL LIFT COMPONENTS

MATRICES REPORT

NODE: C09: SUPPORTABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C34	C35	C36	C37	INDEX	RANK
WTS=>	2	2	1	1		
A02 LIFT+LIFT/CRUISE VLC	10	10	10	10	10	5
A01 EJECTOR VLC	7	10	10	10	9	4
A03 RALS VLC	7	6	7	10	7	3
A04 REX VLC	4	6	4	1	4	2
A05 HFVT VLC	1	1	1	1	1	1

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

MATRICES REPORT

NODE: C08: MAINTAINABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C31	C32	C33	INDEX	RANK
WTS=>	2	2	1		
A03 RALS VLC	10	10	10	10	5
A02 LIFT+LIFT/CRUISE VLC	10	10	10	10	4
A01 EJECTOR VLC	6	10	10	8	3
A04 REX VLC	6	6	10	6	2
A05 HFVT VLC	1	1	1	1	1

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

MATRICES REPORT

NODE: C07: RELIABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C28	C29	C30	C38	INDEX	RANK
WTS=>	2	1	2	1		
A03 RALS VLC	8	6	10	10	10	5
A02 LIFT+LIFT/CRUISE VLC	10	10	6	10	10	4
A01 EJECTOR VLC	6	8	10	1	8	3
A04 REX VLC	3	3	10	6	7	2
A05 HFVT VLC	1	1	1	1	1	1

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RATINGS - VERTICAL LIFT SUBSYSTEMS

MATRICES REPORT

NODE: C09: SUPPORTABILITY

ALTERNATIVES (rows)	CRITERIA (in Columns) C34	C35	C36	C37	INDEX	RANK
WTS=>	2	2	1	1		
A02 LIFT+LIFT/CRUISE VLC	10	10	10	10	10	5
A03 RALS VLS	10	7	10	10	9	4
A04 REX VLS	6	4	6	1	4	3
A01 EJECTOR VLS	6	4	6	1	4	2
A05 HFVT VLS	1	1	1	1	1	1

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

MATRICES REPORT

NODE: C08: MAINTAINABILITY

ALTERNATIVES (rows)	CRITERIA (in Columns) C31	C32	C33	INDEX	RANK
WTS=>	2	2	1		
A02 LIFT+LIFT/CRUISE VLS	10	10	10	10	5
A03 RALS VLS	6	7	6	6	4
A04 REX VLS	6	4	6	5	3
A01 EJECTOR VLS	6	4	6	5	2
A05 HFVT VLS	1	1	1	1	1

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

MATRICES REPORT

NODE: C07: RELIABILITY

ALTERNATIVES (rows)	CRITERIA (in Columns) C28	C29	C30	C38	INDEX	RANK
WTS=>	2	1	2	1		
A02 LIFT+LIFT/CRUISE VLC	10	10	10	6	10	5
A03 RALS VLS	7	7	10	10	9	4
A01 EJECTOR VLS	4	4	10	6	7	3
A04 REX VLS	4	4	1	6	3	2
A05 HFVT VLS	1	1	1	1	1	1

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RATINGS - AIRCRAFT COMPONENTS

MATRICES REPORT

NODE: C09: SUPPORTABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C34	C35	C36	C37	INDEX	RANK
WTS=>	2	2	1	1		
A05 HFVT AC	10	10	10	1	10	5
A02 LIFT+LIFT/CRUISE AC	6	6	7	1	6	4
A04 REX AC	1	6	4	1	3	3
A03 RALS AC	1	6	4	1	3	2
A01 EJECTOR AC	1	1	1	1	1	1

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

MATRICES REPORT

NODE: C08: MAINTAINABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C31	C32	C33	INDEX	RANK
WTS=>	2	2	1		
A05 HFVT AC	10	10	10	10	5
A02 LIFT+LIFT/CRUISE AC	6	6	1	5	4
A03 RALS AC	6	1	1	3	3
A01 EJECTOR AC	6	1	1	3	2
A04 REX AC	1	1	1	1	1

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

MATRICES REPORT

NODE: C07: RELIABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C28	C29	C30	C38	INDEX	RANK
WTS=>	2	1	2	1		
A05 HFVT AC	10	10	10	10	10	5
A02 LIFT+LIFT/CRUISE AC	7	8	6	10	7	4
A03 RALS AC	4	6	6	6	5	3
A04 REX AC	4	1	6	6	4	2
A01 EJECTOR AC	1	3	1	1	1	1

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RATINGS - AIRCRAFT SUBSYSTEMS

MATRICES REPORT

NODE: C09: SUPPORTABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)		C34	C35	C36	C37	INDEX	RANK
	WTS=>	2	2	1	1		
A04 REX AS		10	10	10	1	10	5
A03 RALS AS		10	10	10	1	10	4
A02 LIFT+LIFT/CRUISE AS		10	10	10	1	10	3
A05 HFVT AS		6	6	10	1	6	2
A01 EJECTOR AS		1	1	1	1	1	1

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

MATRICES REPORT

NODE: C08: MAINTAINABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)		C31	C32	C33	INDEX	RANK
	WTS=>	2	2	1		
A02 LIFT+LIFT/CRUISE AS		10	10	10	10	5
A05 HFVT AS		10	6	10	8	4
A04 REX AS		10	6	10	8	3
A03 RALS AS		10	6	10	8	2
A01 EJECTOR AS		1	1	1	1	1

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

MATRICES REPORT

NODE: C07: RELIABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)		C28	C29	C30	C38	INDEX	RANK
	WTS=>	2	1	2	1		
A02 LIFT+LIFT/CRUISE AS		10	10	10	10	10	5
A04 REX AS		6	7	10	10	8	4
A03 RALS AS		6	7	10	10	8	3
A05 HFVT AS		1	4	10	10	6	2
A01 EJECTOR AS		1	1	1	1	1	1

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RAW DATA - MAIN ENGINE COMPONENTS

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C09: SUPPORTABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C34	C35	C36	C37
EJECTOR MEC	2.0	2.0	3.0	1.0
LIFT+LIFT/CRUISE MEC	1.0	1.0	1.0	1.0
RALS MEC	2.0	3.0	2.0	1.0
REX MEC	1.0	1.0	1.0	1.0
HFVT MEC	3.0	4.0	4.0	1.0

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C08: MAINTAINABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C31	C32	C33
EJECTOR MEC	3.0	2.0	3.0
LIFT+LIFT/CRUISE MEC	1.0	1.0	1.0
RALS MEC	2.0	2.0	3.0
REX MEC	1.0	1.0	1.0
HFVT MEC	4.0	3.0	2.0

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C07: RELIABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C28	C29	C30	C38
EJECTOR MEC	2.0	2.0	2.0	1.0
LIFT+LIFT/CRUISE MEC	1.0	1.0	1.0	1.0
RALS MEC	3.0	3.0	3.0	3.0
REX MEC	1.0	1.0	1.0	1.0
HFVT MEC	4.0	4.0	2.0	2.0

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RAW DATA - MAIN ENGINE SUBSYSTEMS

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C09: SUPPORTABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C34	C35	C36	C37
EJECTOR MES	2.0	2.0	2.0	1.0
LIFT+LIFT/CRUISE MES	1.0	1.0	1.0	1.0
RALS MES	3.0	3.0	3.0	1.0
REX MES	1.0	1.0	1.0	1.0
HFVT MES	2.0	2.0	2.0	1.0

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C08: MAINTAINABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C31	C32	C33
EJECTOR MES	2.0	3.0	2.0
LIFT+LIFT/CRUISE MES	1.0	1.0	1.0
RALS MES	3.0	4.0	2.0
REX MES	1.0	1.0	1.0
HFVT MES	2.0	2.0	2.0

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C07: RELIABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C28	C29	C30	C38
EJECTOR MES	2.0	2.0	2.0	1.0
LIFT+LIFT/CRUISE MES	1.0	1.0	1.0	1.0
RALS MES	3.0	4.0	3.0	3.0
REX MES	1.0	1.0	1.0	1.0
HFVT MES	3.0	3.0	2.0	2.0

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RAW DATA - VERTICAL LIFT COMPONENTS

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C09: SUPPORTABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C34	C35	C36	C37
EJECTOR VLC	3.0	3.0	4.0	2.0
LIFT+LIFT/CRUISE VLC	4.0	3.0	4.0	2.0
RALS VLC	3.0	2.0	3.0	2.0
REX VLC	1.0	1.0	1.0	1.0
HFVT VLC	1.0	1.0	1.0	1.0

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C08: MAINTAINABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C31	C32	C33
EJECTOR VLC	2.0	3.0	2.0
LIFT+LIFT/CRUISE VLC	3.0	3.0	2.0
RALS VLC	3.0	3.0	2.0
REX VLC	2.0	2.0	2.0
HFVT VLC	1.0	1.0	1.0

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C07: RELIABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C28	C29	C30	C38
EJECTOR VLC	3.0	4.0	3.0	1.0
LIFT+LIFT/CRUISE VLC	5.0	5.0	2.0	3.0
RALS VLC	4.0	3.0	3.0	3.0
REX VLC	2.0	2.0	3.0	2.0
HFVT VLC	1.0	1.0	1.0	1.0

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RAW DATA - VERTICAL LIFT SUBSYSTEMS

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C09: SUPPORTABILITY

ALTERNATIVES (rows)	C34	C35	C36	C37
	CRITERIA (in Columns)			
EJECTOR VLS	2.0	2.0	2.0	1.0
LIFT+LIFT/CRUISE VLS	3.0	4.0	3.0	2.0
RALS VLS	3.0	3.0	3.0	2.0
REX VLS	2.0	2.0	2.0	1.0
HFVT VLS	1.0	1.0	1.0	1.0

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C08: MAINTAINABILITY

ALTERNATIVES (rows)	C31	C32	C33
	CRITERIA (in Columns)		
EJECTOR VLS	2.0	2.0	2.0
LIFT+LIFT/CRUISE VLS	3.0	4.0	3.0
RALS VLS	2.0	3.0	2.0
REX VLS	2.0	2.0	2.0
HFVT VLS	1.0	1.0	1.0

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C07: RELIABILITY

ALTERNATIVES (rows)	C28	C29	C30	C38
	CRITERIA (in Columns)			
EJECTOR VLS	2.0	2.0	2.0	2.0
LIFT+LIFT/CRUISE VLS	4.0	4.0	2.0	2.0
RALS VLS	3.0	3.0	2.0	3.0
REX VLS	2.0	2.0	1.0	2.0
HFVT VLS	1.0	1.0	1.0	1.0

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RAW DATA - AIRCRAFT COMPONENTS

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C09: SUPPORTABILITY

ALTERNATIVES (rows)	C34	C35	C36	C37
EJECTOR AC	1.0	1.0	1.0	1.0
LIFT+LIFT/CRUISE AC	2.0	2.0	3.0	1.0
RALS AC	1.0	2.0	2.0	1.0
REX AC	1.0	2.0	2.0	1.0
HFVT AC	3.0	3.0	4.0	1.0

CRITERIA (in Columns)

C34 MAINTENANCE COSTS   C35 MANPOWER   C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C08: MAINTAINABILITY

ALTERNATIVES (rows)	C31	C32	C33
EJECTOR AC	2.0	1.0	1.0
LIFT+LIFT/CRUISE AC	2.0	2.0	1.0
RALS AC	2.0	1.0	1.0
REX AC	1.0	1.0	1.0
HFVT AC	3.0	3.0	2.0

CRITERIA (in Columns)

C31 SERVICEABILITY   C32 TIME TO REPAIR   C33 REPARABILITY

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C07: RELIABILITY

ALTERNATIVES (rows)	C28	C29	C30	C38
EJECTOR AC	1.0	2.0	1.0	1.0
LIFT+LIFT/CRUISE AC	3.0	4.0	2.0	3.0
RALS AC	2.0	3.0	2.0	2.0
REX AC	2.0	1.0	2.0	2.0
HFVT AC	4.0	4.0	3.0	3.0

CRITERIA (in Columns)

C28 COMPLEXITY   C29 PART COUNT   C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

SECOND LEVEL RAW DATA - AIRCRAFT SUBSYSTEMS

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C09: SUPPORTABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C34	C35	C36	C37
EJECTOR AS	1.0	1.0	1.0	2.0
LIFT+LIFT/CRUISE AS	3.0	3.0	3.0	2.0
RALS AS	3.0	3.0	3.0	2.0
REX AS	3.0	3.0	3.0	2.0
HFVT AS	2.0	2.0	3.0	2.0

C34 MAINTENANCE COSTS C35 MANPOWER C36 REPLACEMENT PARTS
C37 SUPPORT EQUIPMENT

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C08: MAINTAINABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C31	C32	C33
EJECTOR AS	1.0	1.0	1.0
LIFT+LIFT/CRUISE AS	2.0	3.0	2.0
RALS AS	2.0	2.0	2.0
REX AS	2.0	2.0	2.0
HFVT AS	2.0	2.0	2.0

C31 SERVICEABILITY C32 TIME TO REPAIR C33 REPARABILITY

ALTERNATIVES RAW DATA FOR CRITERIA REPORT

NODE: C07: RELIABILITY

CRITERIA (in Columns)

ALTERNATIVES (rows)	C28	C29	C30	C38
EJECTOR AS	1.0	1.0	1.0	1.0
LIFT+LIFT/CRUISE AS	3.0	4.0	2.0	2.0
RALS AS	2.0	3.0	2.0	2.0
REX AS	2.0	3.0	2.0	2.0
HFVT AS	1.0	2.0	2.0	2.0

C28 COMPLEXITY C29 PART COUNT C30 TECHNOLOGY MATURITY
C38 PART ENVIRONMENT

*U.S.Government Printing Office: 1990—748-056/24390